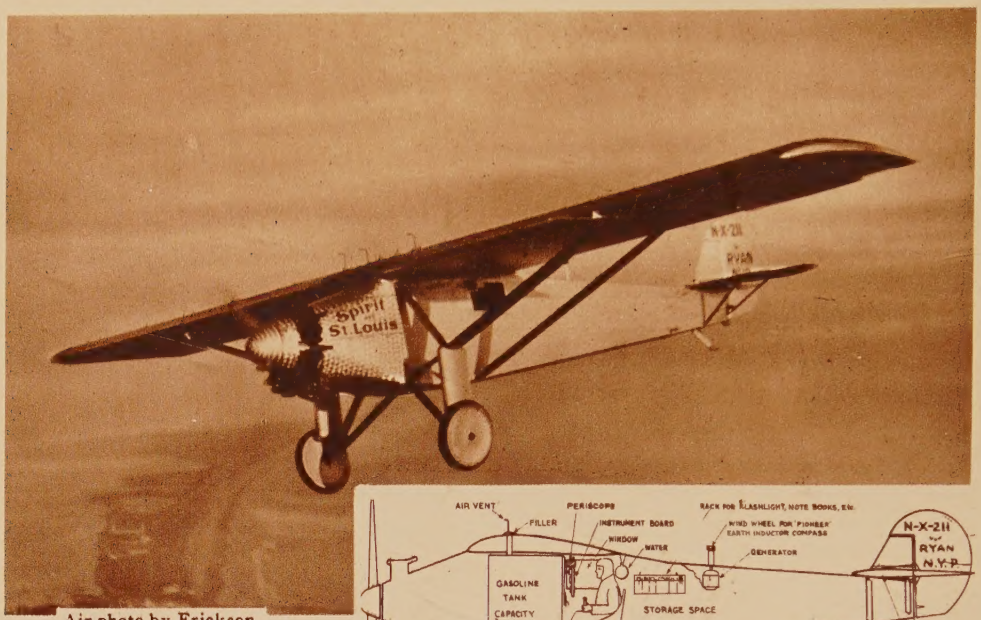
AN "AMBASSADOR WITHOUT PORTFOLIO"



Air photo by Erickson.

Photo from Wide World Photos.

"WE," Colonel Charles A. Lindbergh and his monoplane the "Spirit of St. Louis," made the first non-stop flight from New York to Paris, 3,600 miles, in 33½ hours, taking off from Roosevelt Field at 7.52 A.M. (New York time), May 20, 1927, and landing at Le Bourget at 10.24 P.M. (Paris time), May 21. Carrying letters of introduction and announcing, "I am Charles Lindbergh," the young flier had no thought that the world had been holding its breath awaiting his arrival in France. After receiving, with simple and becoming dignity, from the French, the Belgians and the English, honors such as had never before been granted to a private citizen, the modest and boyish hero was borne in triumph on a warship back to America, where he was given an unparalleled reception by his fellow countrymen. Honors from princes and governments, great popular celebrations and amazing offers left him unspoiled, manly, steadfast, faithful to his purpose—the advancement of aviation.

The BOOK *of* KNOWLEDGE

The Children's Encyclopedia

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WITH AN INTRODUCTION BY

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DEPARTMENTS

The Earth	The United States
Stories and Legends	Familiar Things
All Countries	Our Own Life
Golden Deeds	The Fine Arts
Helps to Learning	Men and Women
Literature	Poetry and Rhymes
Animal Life	Plant Life
Famous Books	Things to Make
Dominion of Canada	and Things to Do

Book of Wonder

VOLUME I

New York

THE GROLIER SOCIETY

LONDON: THE EDUCATIONAL BOOK COMPANY

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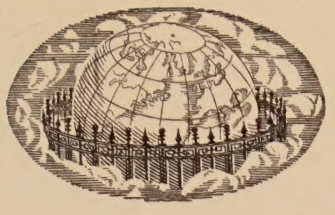

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This is a short guide to the principal contents of this volume. It is not possible to give all of the questions in The Book of Wonder, or the titles of all of the Little Verses and Problems, but in all cases the pages are given where such sections of the book begin. In the big Index, Volume 20, you will find every title and every subject, including the pictures.

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Introduction

READING these books in my mature years, but calling my boyhood self to sit beside me in the reading, I realize what they would have brought to him in those long gone days on the prairies. What I cannot now carry to him, my boyhood self, except as he lives with me in the city or wherever I go in these grown-up days, I can in some measure help to bring to those who are now as he was then; and so I most gladly accept the invitation to write a few words of introduction, though I think that not many of the numberless readers of these volumes, young or old, will stand at the door very long, listening to any one telling of what is within, for every boy or girl, even if grown into man or woman, will find something of compelling interest in these pages. My own lads played no ball the day these books were brought home, nor did they wait to hear my preface, so eager were they to see and to read the articles themselves.

I read these books first in the midst of the busy, noisy, distracting city, and I found myself thinking that their pages were like automobiles, or aeroplanes or street cars or railway trains, carrying the city child into the country among the trees and rocks and birds and brooks and grass and mountains and clouds, where he could see and hear about the wonders of Nature. I read them again on top of a hill, underneath an oak tree, seated on a rock, where I could see mountains all the way round on the horizon; and then I thought how these magic volumes would bring all the great achievements of man, the wonders of his inventing and discovering, to those shut in by the mountains or by the sky on a little patch of flat plain or prairie.

So I am glad to introduce these books to the boys and girls in America, both of the country and of the city, that they may know something of the heritage which comes to them from being born in this world full of mystery, and upon this earth where billions upon billions have lived and left each a little, at least, for those coming after them,—a heritage which is for the most part beyond the reach of the unaided senses of these boys and girls, and which they can occupy as their own only by the help of those who have added the lenses of microscopes and telescopes and other instruments to the lenses of their eyes, who have read in rocks or bones or words the memories of the ages gone, or who have traveled far beyond their horizons in the present. And it is a happy fact that any boy or girl who has a good mind can, with such help, have that great and wonderful and beautiful world added to what he or she can actually see or hear or touch or smell or taste,—added to a little stretch of city, or village street or a few square miles of farm land.

What these books bring is not to take the place of a hard disciplining of the mind. The ability to perform such deeds as are here related comes not merely by reading of them. That power is developed only by days and nights of work and sacrifice. No amount of mere information can make up for the lack of these, as no amount of reading about the water will in itself qualify one to swim or to build a

vessel. But this information may furnish the incentive to work and sacrifice and give to one actually in struggle the benefit of the experience of the thousands who have made that struggle before.

I often call the boys in the public schools of New York my millionaires, not because they have, or ever will have, millions of dollars of their own, but because they have millions upon millions of minutes to spend. A boy of ten, for example, has a prospect of living until he is seventy (though the life insurance companies do not, I believe, allow him so high an "expectation"), which means that he has a fortune of over thirty millions of minutes. Of those millions he will have to spend nearly a third, or ten millions, in sleep, and another third in earning his food, shelter, clothing and other necessities of life. But he will still have a large fortune left to spend as he pleases. The failure or success, at any rate the largeness or narrowness, of his life will depend largely on how he pleases to spend this surplus,—and the poor boy will be as free and as able to spend it profitably as he who has millions of dollars; he can make himself a rich man in character, and knowledge, and influence.

Suppose a boy of ten were to spend fifteen minutes a day (about one-hundredth of his income) in reading these pages, omitting those too young for him or those which require him to give hours in following directions for doing or making certain things, he would probably be able to finish these volumes in two or three years, and he would at thirteen know more about the earth and the life on it than the wisest men knew a few generations ago. For example, though it took men ages to devise an instrument that would carry the human voice across a great distance, yet a boy of twelve can in an hour or two learn how that instrument, the telephone, is made and operated. And this encyclopedia is full of such information to help the boy begin his youth or manhood a little farther on than his ancestor.

I would have this work in every school as a library of supplementary readings—readings that will not be looked upon as "lessons." Indeed one might teach a child almost entirely from these volumes, for several years. But this encyclopedia is primarily a home book and not a school book. It is not like a grown-up encyclopedia, a work of reference which one does not think of reading consecutively or for pleasure (though I have myself read through an encyclopedia of several volumes and found it intensely interesting and profitable reading). This is an encyclopedia in that it gives the child or youth possession of the whole cycle of existence and circle of truth to which he is entitled by birth. The city boy and the country boy find themselves inhabitants of a universe a thousand times more wonderful and interesting than that which most of their elders knew at their age or dreamed of. And I can think of no good reason for keeping them from it. The facts of physics, biology, astronomy, history and language learned in these boyhood, girlhood days are never forgotten. Through them the child has inextricably woven into his being the life of the race and of the earth, who might otherwise be only a child of a certain valley or prairie, or of a certain street or tenement.

I often go back to Abraham Lincoln and try to imagine what this or that means or method of modern education would have been to him. Would it have helped or hindered in the making of such a man? Would these richly illustrated, absorbing books, I ask myself now, have tempted him from the later hard mastery of the few

books that fed his genius? Would they have made too easy the path to the knowledge which mankind has reached by the direst suffering? It is possible that this would be the effect upon a sluggard or a vain mind, but the former would not in any case hold itself to Lincoln's course of discipline, unless it found such spur as lies in these pages, and the vanity of knowledge is so rare in the child's mind and so easily cured that it needs not to be considered. A normal child's eager mind, this encyclopedia can but nourish and protect,—a mind that knocks inquiringly at all doors and drinks at all fountains, pure and impure. Here is a sanitary fountain, that bubbles up to every thirsty child. Here is a door that opens upon healthful fields.

The American home, especially in the city, is menaced by so many economic and social influences that one is glad to encourage any effort that will work against these. This little library making the child's world revolve around the place of its reading, will make many a home a more attractive centre of boy and girl life. The hearth has disappeared, but if such a library of good books could take its place, drawing the family about it, the social value of the hearth would be restored where now the cheer has flown into the street. So again I commend these as home books.

I have spoken of the boyhood self who sat beside me in the reading. But his opinion is not wholly untouched of age. I therefore turn to one of those thousands for whom all this treasure has been gathered and ask him to give ending to this introduction. He, a boy of seven, was being nursed because of a serious hurt and would be read to. And the book that he asked for was the last volume of THE BOOK OF KNOWLEDGE.

JOHN H. FINLEY.

To Our Readers Young and Old

FIFTEEN years ago the editors sent out the first edition of THE BOOK OF KNOWLEDGE to English-speaking boys and girls. During those years many things have happened upon this earth of ours, many new inventions have been made, and men and women have continued to think and to write on many questions. Now we give you a new and larger BOOK OF KNOWLEDGE, which keeps the best of the old, and yet adds many things which boys and girls should know of this ever-changing world. You cannot find another set of books like this, for no one else has succeeded in putting together those things which will help boys and girls to understand themselves and the great world around them, and in telling them in simple, clear words. Since THE BOOK OF KNOWLEDGE was first made, special editions have been printed in French and in Italian for the children of those nations, in Spanish for our little friends in Spain, Cuba and South America, and in Portuguese for the boys and girls in Brazil.

In order to write the articles for you, the editors and their assistants have read many books, printed in many languages; they have looked into the laboratories where scientists are working to solve the many puzzles of the world around us, and to find its secrets; they have gone through the busy workshops where the things we use every day are made; they have worked in hospitals where men and women struggle to conquer disease; they have selected from the whole field of our literature some of the most beautiful thoughts; they, or those working for them, have gone to and fro over the whole earth to find interesting things and have brought back stories and pictures for you to read and to see.

They have told you the stories of the sky, the sea, the earth, and of life upon the earth, in the sea, and in the air; and have shown you how one thing affects another. They have shown how the rain, the wind, the heat, the cold, the life of plants and animals in ages gone by, make possible our life to-day. They have told you the story of man from the beginning. They have told you of the lives of some of those men and women who have influenced the world. The story of all the great nations which have risen and ruled on the earth has been given you that you may see where they succeeded, where they failed, and what they have given to the world. Best of all, they have told you of these wonders in words that you will understand.

Your editors have worked together to make a book for English-speaking children no matter where they live. We have made a book for the boy on the lonely Australian sheep farm, as well as for the girl in the New York apartment house. Boys and girls on farms in Kansas or Manitoba, among the Scotch mountains, on Southern cotton plantations, in the far-away Philippines, in India, in Japan, in Africa, will all find that the book has much for them. Wherever boys and girls speak English, sets of these books—yours and ours—will go, to help them to become bigger, wiser, better men and women. With every set will go the good wishes of all the editors who have worked with the book until they love it.

HOLLAND THOMPSON.

The Meaning of Our Book

THIS work is an attempt to bring together that part of human knowledge really worth while, so that even a child may understand.

Nothing could be more false to its purpose than to imagine that it seeks to cram the mind with things that children need not know. It is based upon a definite idea of education which the editors have developed both from study and experience and which they have worked out in the volumes now before you. The bringing up of a child is conceived as the supreme task in which we can engage, but there is no sympathy with those who would set a child down at a desk almost before it can run. It is believed that in the early years a child is its own teacher, and that in a right environment it will teach itself more than all the teachers in all the schools can teach it.

It cannot be urged against this book, therefore, that it has come to steal away the joy of childhood and put a bitter grinding in its place. It has come, indeed, to bring more joy to childhood, believing that true joy of life comes from sympathy and understanding. One half of the population of the world is made up of boys and girls learning at school and little children playing at home. The editors have sought to convey to this vast multitude of men and women of to-morrow such an understanding of the world they live in as shall make their lives happier, and save the waste of precious years at school.

Left to wander in this field, the child will find whatever it wants. For the youngest of all, its nurse will find her lullaby. The child in the nursery will find its nursery rhymes, and all the best stories that have ever been told. The child who can be left out of doors to play will find here the beginning of its interest in natural things. All the games and pastimes, all the fireside enjoyment the children love, the mechanical interests of boys, the domestic interests of girls, and home-made toys for both of them—this is but one phase of the practical value of the book. For the boy and girl at school these pages teem with precious things; for fathers and mothers, teachers and governesses, they may well become invaluable. It is a book for grown-ups and children too—to be read *by* children or *to* children. It is an encyclopedia of everything that comes into childhood, and by childhood is meant all that period of life when the sensitive mind is being formed by the influences about it.

THE BOOK OF KNOWLEDGE is what it pretends to be. It is not a children's book that children cannot read. It is written in the words the children know. The art of saying things simply has long been dying out, but the writers of this book are seeking to revive it. The writers have been simple by being natural; they have made a children's book without childishness, a book that children may read because it is simple, and that men may read because it is plain. The great mysteries of the world about us have been made as clear as words can make them. It is a story that will never fail for children who will never tire, and while the child will find its sense of wonder grow, it will find, too, that its mind is widening all the time, understanding more and more.

ARTHUR MEE.

The Purpose and the Plan

THE fundamental purpose which the editors of THE BOOK OF KNOWLEDGE have kept constantly before them is the development of the child in the broadest sense. The work has been planned to aid in his education, not so much by making the acquisition of knowledge easy, as by making the process interesting. The design has been, first, to awaken in the child's mind a lively interest in the great world about him. The growth of self-reliance is encouraged by leading boys and girls to investigate for themselves. The unity of all knowledge is clearly shown; and finally the whole work teaches profound reverence for truth, and sets high ideals of conduct.

The reason for including every department will be apparent after examining the work. The wise parent will not neglect the opportunity offered by the book to study the natural disposition and capability of his child. A valuable forecast of his future may sometimes be obtained from his attitude toward the various departments. It is quite possible that a boy's life-work may be indicated, and possibly determined, by his possession of these books.

The editors do not intend the volumes to duplicate text-books, but to supplement them. They are not simply a collection of facts, but something much more valuable. In them the child will find many subjects treated at length which are barely mentioned in the text-books. On the other hand, the child who has had these books in his possession will be able to understand and to comprehend much taught in school which might otherwise pass over his head. The child, owning and using THE BOOK OF KNOWLEDGE, will easily outstrip his comrade of equal ability without this advantage. Thousands of parents and teachers can testify to this fact.

The titles of the eighteen great departments included in THE BOOK OF KNOWLEDGE are upon the title page. The arrangement of these departments, however, differs from that which may, at first thought, seem logical. Instead of devoting a volume or volumes to each, the departments are distributed throughout the set, one or more sections appearing in almost every volume. This distribution, nevertheless, has its root in sound psychology, and this unique arrangement has been found to be one of the strongest features of the work. The pedagogical reason is this: *the average child cannot concentrate long upon those subjects which require close attention. After a comparatively short period, he must change his occupation or rest.*

In accordance with this principle, therefore, the subjects are treated in articles of varying length, but no section is so long that the endurance of the normal child will be unduly taxed. For the unusual child or for the normal child, urged on by special interest in a subject, the page on which further treatment may be found, is indicated at the end of each article and to this page he may turn, neglecting for the moment what lies between. On the other hand, a child who has been reading a story, or looking at pictures of fire engines, very often goes on to read a less thrilling

chapter on chemistry or physiology, or perhaps some poems, because they come next. These might be neglected if he had been compelled to go to special volumes for them. Further, since no fact stands alone and since our real and vital understanding of any fact depends upon our recognition of its relation to other facts, cross-references are extensively employed. Thus history, biography, geography, art, literature and science are all linked together.

The text-books have begun to follow THE BOOK OF KNOWLEDGE in the extensive, even lavish, use of pictures in teaching, but they are still far behind. Reading is really a complicated process. The child must translate the symbols into words, the words into ideas, and the mental images are often confused in consequence. A good picture, illustrating scenes in foreign lands, manners and customs, methods or processes, is often the flash of a search-light into mental obscurity. The child is given two chances to remember and understand instead of one. Over fifteen thousand illustrations present a panorama of the world.

A Word to Parents

THE BOOK OF KNOWLEDGE is a child's encyclopedia. It is a great source book of information to which he can turn when curiosity stimulates the desire to know, or when he needs information to complete any schemes in his work or play. It was felt that no such book was complete which did not include some scheme of self-teaching for the child who wants to *do,* as well as to *know.* He not only wants to know the "why" and "wherefore" of the great world about him, but he wants to know the "how" of doing. He wants to know how to skate and to swim, how to paint and to draw, how to model, how to make a kite or a radio; he even wants to know how to spell, to write, to read and to calculate if we can find ways and means of helping him to see these as life-skills needed by everybody, whether adults or children. This is true especially when we plan methods which make it possible for a child to learn them through his own initiative. Games which involve practice in these school arts stimulate him to repeat them over and over. This interests him in "bettering his own best," in perfecting his own skill. Through such methods as these the child responds more intelligently and wholeheartedly to our invitation to help in his own education.

Children's spontaneous activities are not all of equal value. Some of them are crude attempts at the beginnings of art, industry or science, while others tend to perpetuate useless or harmful modes of expression. The child himself is too ignorant, too inexperienced, to evaluate his own spontaneous acts. To learn which are to be eliminated and which perpetuated he must have some kind of guidance, or he may repeat good and ill alike. In later life we usually learn which acts are to be encouraged through the attitude of our superiors or our friends, or through our own experience in experimenting with materials. A child can, and does, learn in all these ways, but he must have guidance from some source to help him to weed out the useless and harmful and to select and repeat those which lead to the higher levels of civilization.

In a good modern school a teacher not only offers criticism herself when needed, but helps the child to respond pleasantly to the suggestions of his fellows. She also helps him to learn to pass judgment on his own work. It is interesting to study the effects of wisely conducted group criticism in a socially organized school where conditions make it possible for children to learn from children as well as from the teacher. Often children feel that grown people do not understand or see life from their standpoint. When kindly criticism comes from their comrades—their playmates—it frequently goes to the heart and is accepted in the spirit of fair play as no adult criticism is received.

Child-life is pre-eminently a process of learning. Children are ignorant and inefficient. They learn much through the method of "trial and error." They are

blind, wayward little bunglers, often making poor success in the process of learning how. This tempts us grown people to spend our lives and theirs in much useless, unproductive and irritating correction, which helps neither them nor society. Few grown people could bear with courage, patience and good-will the endless correction which most little children endure from the average adult. Dr. William Burnham, in the Normal Mind, puts it so aptly that a long quotation is justified.

"The teacher's habits, at least in the school situation, are those of order, methodical activity, accuracy of statement, care in the expression of one's thoughts, and, in not a few cases, primness, conventional behavior, and probable pedantry in regard to pronunciation of words, forming of sentences and the like. The child's habits, on the other hand, are those of freedom, refreshing disorder, carelessness in expression, unconventionality, lack of pedantry, whether in behavior or in grammar, and a natural spontaneity that may be pleasing outside the school situation but is likely to be taboo within the school group. With this enormous difference in the habits of the teacher and the child it is no wonder that irritation, aversion, discord and the age-long conflict between teacher and pupil have often developed."

For this reason the great educators of the last half century have been seeking some method of educating young children through their own activities and initiative. They have hoped by some such method to be able to reduce the constant necessity for correction and criticism. Froebel in the middle of the last century introduced plays and games in order to gain the child's wholehearted co-operation in his own education. Before his new method received the name of kindergarten, he called it "an institution for the self-education or self-employment of little children."

A half century later Dr. Maria Montessori coined the expression "auto-education." She not only used materials for education through the child's own activity, but invented materials which carried with them the means whereby the child could detect his own errors. Through these materials Dr. Montessori hoped to relieve children from undue dependence upon grown people's judgment and their constant tendency to *correct them.* In other words, while Montessori's materials do not stimulate creative action and originality as do Froebel's, they do suggest to the child certain definite activities, which, if followed correctly, lead to success. On the other hand, any failure is so self-evident that a child needs no grown person to say, "That is wrong." He discovers his own failures, and through his own judgment makes the correction which gives him the satisfaction of saying to himself, "Just Right."

A wholly self-corrective scheme of education tends to underestimate the value of learning through the help of others; that is, through the criticism passed by superiors and equals upon our daily work and play. In life we *have* to learn in all ways, as our acts are checked by others as well as by ourselves. But it is possible to create self-corrective materials which grow out of the natural situations in a child's daily life.

The two learning situations in which little children pass most of their time are the home and the school. The school laws require the guide in the schoolroom to spend much money and time in learning how to plan the process of learning in that institution; but, as a rule, the guide to the little learner in the home—the most important and most potent learning situation in the world—enters on her guidance

without any preparation. The average mother is face to face with her own lack of preparation before she realizes the serious problems she is facing.

When the editors of THE BOOK OF KNOWLEDGE asked us to help them plan home education along the line of the school arts, we thought the only wise solution would be a series of activities or games involving these arts embodied in activities with self-corrective materials. In this plan of activities and games evidences of error can be detected by both mother and child. Even an untrained mother who will conscientiously use them can help her child in his self-education and reduce to a minimum the danger of mistakes due to her own lack of training. The materials by which the child, or, better still, the children, teach themselves are as largely self-corrective as Mrs. Waring could make them; but as she herself says, they are not "fool-proof." There is not, and never will be, any fool-proof method of teaching human beings. On the contrary, these materials call for the mother's intelligent and wholehearted co-operation and her watchful checking; but they can be used with a fair promise of success by any intelligent and conscientious mother. In other words, the self-corrective aspect of the materials guides the untrained mother, as well as the learning child.

It is the writer's conviction, however, that no wholly self-corrective plan of education is sufficiently broad to utilize all the sources of stimulation to thought, feeling and action which that situation makes possible. While it is true that in the past most teachers were not trained to see or utilize opportunities provided for children to learn through self-correction, it is equally true that there is, and always will be, a place in any scheme of education for the teacher to enrich the child's learning through her reaction to his self-teaching. Her reaction is, or should be, influenced by a knowledge of the laws governing the child's mind and the learning process.

Mrs. Waring was chosen to plan this scheme of home education, first, because of her large experience in creating and using these self-corrective materials with success in the school; and, in the second place, because as a mother she had the problems of the home and mother well in mind, gained from her experience in working these out in the home as well as in the school.

Miss Matthias, our artist, has, as a supervisor of fine and industrial arts in our public schools, gained a rare insight into the curriculum and also into the place of art in relation to the whole.

The self-corrective idea is valuable in both the home and the school, but it is especially valuable in the home where the mother cannot give her whole time and attention to the teaching of her children. With Mrs. Waring's plan, she can start the child correctly, or, better still, see that he has started himself correctly, while going on with her manifold duties as a home-maker, but she must return from time to time to check up the child's self-teaching and be sure that it is proceeding correctly.

Self-corrective materials may aid the child in discovering and learning facts and processes of which he can make use in his work and play. In so far as they stimulate group games, they may aid also in the development of standards of social behavior on a basis the child can readily understand. But the arts—music, dancing, drawing, painting, modeling and construction—are largely beyond the limitations of self-cor-

rection. For example, from the artist's point of view, a child's crudest attempt to paint a flower or fruit is far better art training, especially if he is so fortunate as to have a teacher with ability to measure and help him to measure his approximate success, than any amount of "filling in" with crayon or paint a far more perfect form drawn by an adult. To a limited extent, however, the arts enter legitimately into the *practical* problems of the child's work and play. To that extent Mrs. Waring has utilized them in this series of worthwhile things to do.

Mrs. Waring has, with infinite patience and attention to detail, worked out a most successful scheme of self-education for a home. The directions are made simple by the abundant use of pictures which serve as a language which the child can interpret more easily than words. This is especially true because Miss Matthias is an artist who has insight into children's lives and needs. If mothers will be conscientious in providing playmates and in encouraging and helping the children to make and play the games the materials provide, the children can make substantial progress in acquiring many of the school arts usually taught in the kindergarten and the first and second grades. The child can, and will, enter upon self-teaching if the materials are provided by the father and mother; but he cannot without adult help achieve these results. Through this plan we are trying to help the child who wants to learn through his own efforts, as well as the mother who is eager to help the child in his self-teaching. It will take the best efforts of both to achieve success. We wish both all success in this worthy undertaking.

PATTY SMITH HILL.

Helps to Learning

DEAR FELLOW PARENTS: Have you decided what to do with the little folk this fall? Shall you send the active little four-year-old to kindergarten or wait until he is five? One of your friends is sending her three-year-old to nursery school. You know she doesn't need to, for she can have anything she wants and all the help she needs at home. What is it you are both trying to provide for your children? It is not that either of you is so eager for them at three or four or even five to get to learning the skills that you learned in your first schooling, the reading, writing and numbering. Important as these knowledge skills are to them in later years, you are more concerned, especially in their early childhood, with how they *behave* than you are with what they know.

Whether or not you send the children to nursery school, to kindergarten or to primary school depends largely upon whether you think they will learn better how to behave there among other children than they will at home with you.

There are certain things which children under six can learn to do. They can learn, for example, about common things, their color, shape and other qualities, what they are good for, how to play with them, and how to make things out of them. They can become skillful in many such ways, but the important question is *what use do they make of their skills?* Do they get as much enjoyment out of guiding the wagon into other children's blocks or mud pies as they do in guiding it carefully up an inclined board and safely down again? How do they decide all day long what to do, how to do it, and how well? In other words, what are their *standards* of behavior? These will largely determine whether they shall live meagre or abundant lives, whether they shall be permanently happy and socially valuable. And they are determined largely in a child's early years by the parents and adults who are about them.

There are ample opportunities in the natural experiences of children, either at home or at school, for them to discover and to develop both the necessary skills and the desirable habits and attitudes which build standards of behavior.

If these opportunities seem to you meagre, or if your children are not making the discoveries and the developments in behavior which you desire for them, investigate. You can find ways and means of improving them, for the limits of the children's opportunities are fixed very largely by the amount of intelligent effort with which the parents or adults select, approve and guide them into desirable ways of behaving.

Whether or not you send them out of the home for a part of each day is a matter for you to decide differently perhaps for your several children. You will have to judge of the school opportunities exactly as you judge of the home opportunities. And, whether you send them to school or not, you will wish to make the

home opportunities just as inclusive and just as valuable for them as you possibly can, from babyhood on.

In infancy you set all of the standards of behavior for your child. He learns to discriminate and to choose between good, better and best ways of behaving according to the amount of satisfaction he gets. Those acts which give immediate and evident satisfaction, he tends to repeat. Those which bring no satisfaction, or which cause pain, he tends to avoid. If you consistently approve the same desirable acts and see that he always enjoys their consequences, and as consistently disapprove and make unpleasant undesirable action, you can largely determine his habits of behavior.

If at the same time you let him know by some simple words *why* you approve of some things and disapprove of other things he does, he gradually becomes aware of the differences between desirable and undesirable ways of behaving. Up to this time it is all a matter of chance with him. He acts as he *feels* like acting, and then helplessly accepts the results that happen or that you administer. But gradually he discovers that these results do not just happen—that you do not, as he does, act just as you feel like acting. He discovers more—and this is a momentous discovery—that you do not just arbitrarily decide about what he shall do, but that you think it out, and THAT HE CAN THINK IT OUT HIMSELF AND OFTEN WITH THE SAME RESULT. Resentment against your direction wanes. He comes to *share* your standards of conduct, and, as he gains both in insight and in control, he will select and direct what he does by these same standards which have prompted you.

In so far as he does this, he can profit by the freedom you give him to choose and to direct his own activities. But freedom is destructive in activities where he has not already established habits of good behavior, standards by which he knows good from bad ways of behaving, and greater satisfaction in the better ways of behaving. Self-direction is most to be desired for your child and at as early an age as possible. It insures his happiness and efficiency. But it comes far more by patient planning and careful conversation than by mere desire and freedom. It involves the most ardent and intelligent effort on the part of the adults who make his early environment, for first he must accept their standards of what is desirable conduct, gradually become aware of them, and then deliberately build them into his own independent behavior.

The purpose of this section of THE BOOK OF KNOWLEDGE is to help you select those standards of conduct which little children are able to recognize and apply, and to suggest ways and means by which these standards can be made to appear and develop through the natural activities of early childhood.

Day in and day out the children are making things and playing with them, or they are trying to do some new and difficult feat they have seen others do. Perhaps on a hot day they make a cold drink stand and sell grape juice to the passers-by. When customers are missing they play a game with the metal tops from their bottles, then they turn to playing ball or practicing some new stunt with a kite. Whether they are engaged in constructive and dramatic activities or in skill activities they are constantly having to decide *what to do* and *how well to do it.*

It appears from a study of children's language that certain standards underlie

these decisions. In making something the child wants it "to work." In doing a "stunt" he wants to do it "just right." In playing a game he wants "to win." When he starts to play a game or make a toy he wants "to finish it." In drawing a picture he wants to do it "alone." In bouncing a ball he wants to catch it "every time." In running a race he wants to run "as fast as he can." Every day he wants to catch the ball "more times" and wants to run "faster."

All these are evidences of standards of behavior it is natural for him to use on occasion. What can you do to increase the opportunities for him to use them, and to help him use them with more and more knowledge, certainty and purpose? As you increase the number and the variety of constructive and skill activities in which he can engage, you can help him to extend the application of these simple standards of utility, "good enough to serve the purpose"; of skill, "the very best I can do"; of independence, "I did it alone"; of perseverance and completion, "I finished it"; of speed, "I did it fast"; of accuracy, "I did it every time," or, "I did every one," or, "I did it all right"; and of progress, "I did more," "I did it better," or, "I did it faster."

You can help the children to make and use such standards when they are deciding what they will do and how well they will do it. Sometimes you will plan deliberately to establish standards. Then throughout the day in all their varied experiences, you must be alert that the standards you do establish are faithfully and consistently adhered to on your part and recognized by the children. In this way they will become the habitual controls of their behavior, operating every time they have to decide what to do or how well to do it.

This department offers suggestions for that part of the day in which you are deliberately establishing standards for desirable behavior. It is directed to the child, and, as you read it to him, it serves as your share in a conversation between yourself and him. No pauses can indicate his entrance into the conversation for it cannot be foreseen just where his interest and capacity will prompt him to respond to the questions or suggestions made. But you will need to be alert to his remarks, for they will indicate the matters about which he is ready to receive help or direction. To avoid burdensome detail in matters which require adult supervision or help, notes will be directed to you so that they will not distract the child.

The plan covers largely the essential skills for kindergarten primary children, but only as they enter into the experiences the child will find natural and worthwhile in and of themselves, things he will enjoy making and playing, and skills he will delight in acquiring—in other words WORTHWHILE THINGS TO DO.

There is nothing arbitrary or fixed in the order in which different activities are described. In general those things come first which are most easily and naturally acquired by children in their home and early school environment. In general also the standards of behavior are first labeled and used in the physical activities of the child, and only after they are thoroughly understood are they applied to more mental and social situations. The thoughtful parent will have to supplement if she finds the child does not understand and apply the language labels of "just right" and "not right." She will provide many additional opportunities for him to discriminate between right and not right ways of doing things with his legs, arms, hands, fingers, eyes, ears and so on, until the standard works in this field where the difference be-

tween right and not right is evident. Only when she knows he is ready will she go on with the activities suggested in the book.

In general also, the activities in any volume are varied, and together they make a more or less complete unit of experience for the child. Out of the experience he should discover that he has learned certain desirable skills. Gradually in later experiences he anticipates more and more that he is going to learn something interesting. He looks forward to this learning as well as to the winning of scores in the games. He no longer chooses games merely for their physical or social opportunities, but he chooses individual and practice games which he knows will help him win more games. He even chooses some drill activities just for the satisfaction he gets out of successful learning. So game materials are planned which will serve all these purposes.

One child can use them either to discover new facts or to drill himself on them until he knows them. Also he can do either of these things with another child or group of children. Usually only one of these uses is described. Other uses may be indicated for some of the early games, and thereafter you will know how to modify the procedure for any of the other uses desired.

Enough detail is included in the text to make clear one way children have played with the material happily and profitably. You may yourself think of other uses equal or better, and it is to be hoped your children will invent their own rules of the game. Other things being equal, the child's own game will avail more than either yours or mine—avail more in the learning of desired skills and much more in the development of standards of behavior.

If you have carefully studied the suggestions yourself, you will be prepared to utilize every suggestion your child makes, and direct it so that it will contribute to the specific learning both of skill and of standard for which you are aiming. The blind make poor leaders of the blind, so it behooves you to be saturated with the purposes and possibilities of the suggested work before you undertake it with the children. You will then be able to get their utmost interest and co-operation. The text is so simplified by pictures that the children can readily follow the meaning as you read to them how to make or how to play the games.

The more the child helps in the making and the more responsible he is for the playing and scoring of the games the better—*within limits*. So long as this participation in the making of the game materials does not interfere with the successful use of them as planned, he is the gainer for his part in the making. While making he is learning the skills which the game is planned to teach him. For example, by the time he makes a simple game for the recognition of the digits 1, 2, 3, 4, and 5 he probably knows them and he requires only the further drill that comes from playing the game to fix the learning permanently. But if by ignorance or carelessness he makes the game so that he is learning things that are not so, as learning to call 5, three, then obviously it is better for you to assist him in making up the game material until he is better able to follow the directions.

Let the child do what he can do with reasonable success. Anticipate his difficulties and help him while he is still experiencing success, so that he may continue to experience it. Success whets the appetite for effort. As long as you can keep him succeeding, he will continue to learn with eagerness. Just as his success begins to

wane, suggest or help in such an inconspicuous and genuine a manner that he will not resent your help as interference, but will rather respect it for its worth, his past experiences having taught him that your suggestions bring fortunate results.

There is a limit likewise to the child's part in the playing and scoring of the games. The materials are planned to be as nearly "fool-proof" as possible. They suggest to the child what to do, and in so far as possible they suggest nothing else to him. They show him when he is right, and they also show him, if wrong, what is the right way to play. To make assurance doubly sure, the text describes in detail at least one way to play the game. All this is done just so the child may safely be left to direct the playing and scoring of his own games, and yet be sure to learn the desired skills and standards. But if you find he is learning something which is untrue or undesirable, you must correct his procedure, not as a critic or faultfinder, but as a player, an umpire, or an interested and questioning observer.

So it seems equally necessary to say, "Don't do anything for the child which he can do for himself with reasonable success"—(with the warning "Don't stretch beyond the elastic limit either his interest or his capacity to understand and follow direction"); and, on the other hand, to urge, "Assure yourself that the children are making a game correctly and using it wisely before you leave them to continue it without your guidance."

What is good behavior at one time and place may be bad behavior under different conditions. If a child knows how to use a hammer safely, and he uses it to pound the nails which hold the tongue on to his cart, that is good behavior. It is less desirable if he bruises himself, if he takes the hammer away from sister, if he takes for a tongue a piece of wood brother was saving for his kite, or if mother has told him to take his rest. When he decides what to do he must consider other people. All standards of behavior are social in nature; whatever one does affects others.

The child needs to learn this, and you can best help him to learn it by bringing other children to share with him these worthwhile games in which he is discovering about standards and how to use them. The group games are better teachers of good behavior than are the games he plays alone. So if you are depending only on home opportunities, bring other children to share the games just as frequently as you possibly can.

If your child gets companionship with other children at school, you can help him carry over into his school activities the same standards of behavior you are establishing at home. Bring some of these same children into your home frequently. Let them share some of the games he has helped to make and knows how to play in ways which require these standards. Encourage them also to play some of the games which they play on the school yard. You can help them apply these same standards to them. The oftener you do this, the more likely is it that this same group of children will behave the same way and use the same standards when they play the same games on the school yard.

Any standard of behavior can be depended upon only when it works under varied conditions, the conditions at home, at school, on the street, with other children or alone, when grown-ups are present, within call or out of reach. To make any standard generally useful, do what you can to give it exercise under all these conditions.

ETHEL B. WARING.

THE SPACE NO MAN CAN MEASURE: RIDING

40 YEARS to NEAREST STAR
740 YEARS to JUPITER
76 YEARS to MARS
50 YEARS to VENUS
170 YEARS to SATURN
2855 YEARS to URANUS
4560 YEARS to NEPTUNE

This picture helps us to realize what our minds can hardly understand —the wonderful size of the universe and the immeasurable distances in space. These trains represent the fastest ordinary means of travel yet invented, the express train traveling a mile a minute, fast enough to go around the world, if there in less than eighteen days. Y years to travel from the earth which they could travel a mil

TY MILLION YEARS TO THE NEAREST STAR

y and nothing to stop it, as these would take 177 there were a railway on never stop; and a train starting from the earth for the nearest star would not arrive for forty million years! Our artist has drawn an imaginary railway line leaving the earth for the planets, and the figures on the trains give the time it would take, at sixty miles an hour, to reach the planets.

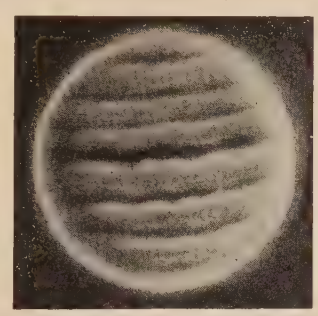
WHAT THIS STORY TELLS US

HOW still the earth seems on a moonlight night! Yet the earth has never been still for a moment of time. We do not know how long it has been spinning, but for millions and millions of years it has been flying like a ball through space. It began as a cloud of fiery gas; it cooled and shrank; and at last it became hard and round like an orange. And, as we now know, the earth is like a speck in a boundless universe, one of the smallest of a thousand million worlds, all moving on and on in perfect order through space that seems to have no end. What are they like? Are they alive? Are little children playing there? Perhaps not; we do not know. But they have their place in God's great scheme of things, and here we shall read all we can know of them until the day when our eyes shall see and our minds shall understand the marvelous purposes of God.

THE BIG BALL WE LIVE ON

THE big ball we live on, with its mountains and rivers and seas and deserts and forests and plants and animals, is only a speck in the vast infinity of space.

It is surrounded by millions of suns, and planets burning and spinning, and by millions of suns and planets born untold ages before the earth came into being, which have now burned out and become dark. In comparison with its own sun, the earth is a tiny thing, and if it were a little nearer that shining star it would be drawn into one of its fiery whirlpools and devoured like a daisy in a prairie fire.



Earth cooling down.

And there are many suns in space, some many times as large as ours. Besides suns and planets, there are tremendous clouds of glowing substance known as nebulæ, so huge that the earth in the middle of one of them would be like a pea in the Pacific Ocean. In space itself the earth is quite lost. Think of the width, and breadth, and height of space!

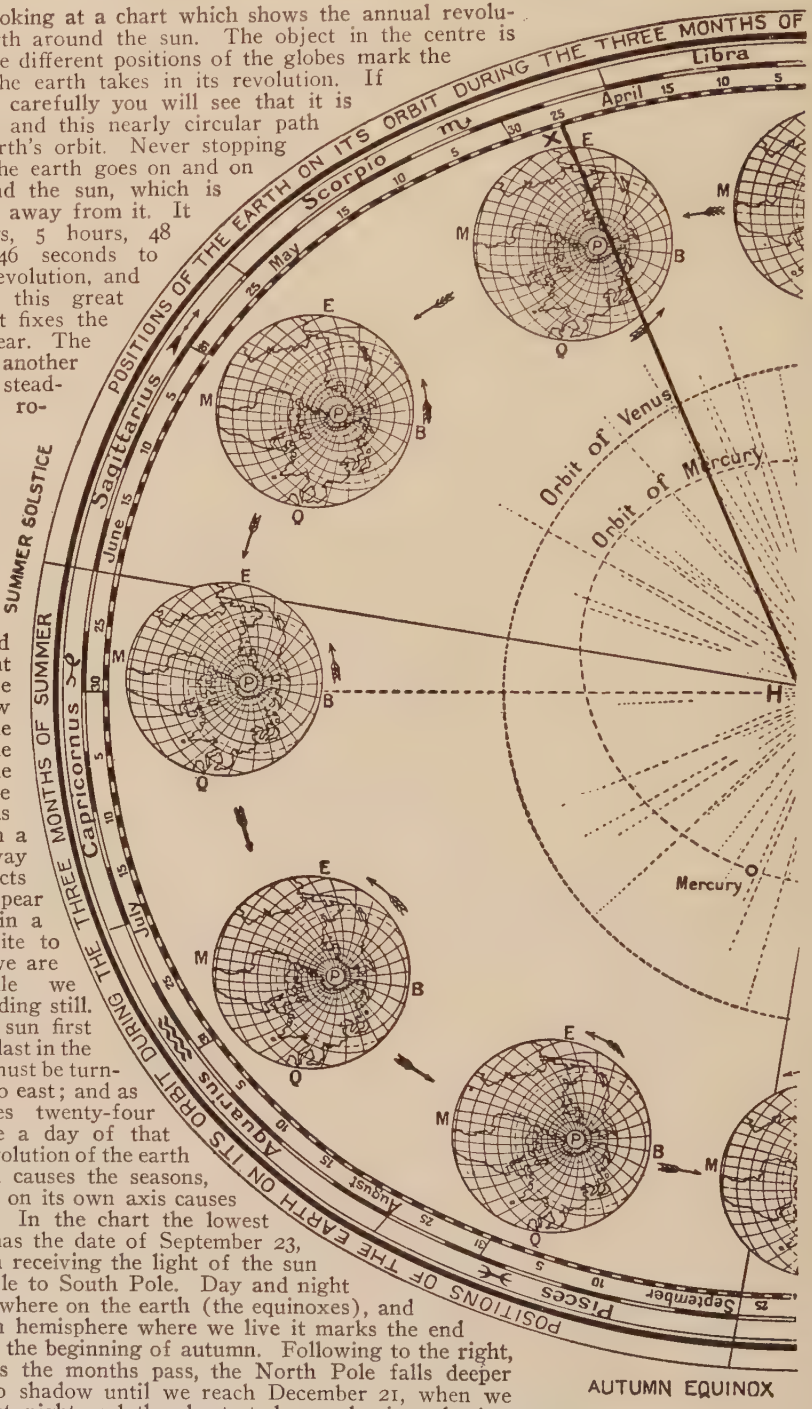
The sun seems a long way off, but its light takes only a few minutes to flash across to us. Astronomers who have been measuring the distances of stars have calculated that some of them are so far off that light, which travels 186,000 miles in a second, takes hundreds of years to reach us. An express train would take hundreds of millions of years to cover the distance. Even farther off than that there are stars; for every time a bigger telescope is made new stars come into view. The big Hooker telescope on Mount Wilson revealed thousands of stars out beyond the stars that were previously known.

So little, then, is our big ball, when we look at it amid the suns and nebulæ in the immensity of space. But we must not, therefore, think less of our earth.

We who rush round the sun in such a wonderful chariot, with the stars millions of miles away shining into our eyes, must recognize that the earth's place amid the suns is a place of wonder and a place of honor. We are proud when we go sixty miles an hour in a motor car along a road; but what an adventure it is to go flying a thousand miles a minute round the sun, companioned by Jupiter and Venus and Mars—to go flashing with the sun along pathless space toward some unknown goal. Life can never be a stupid and dull and sordid thing if we educate

THE ANNUAL REVOLUTION OF

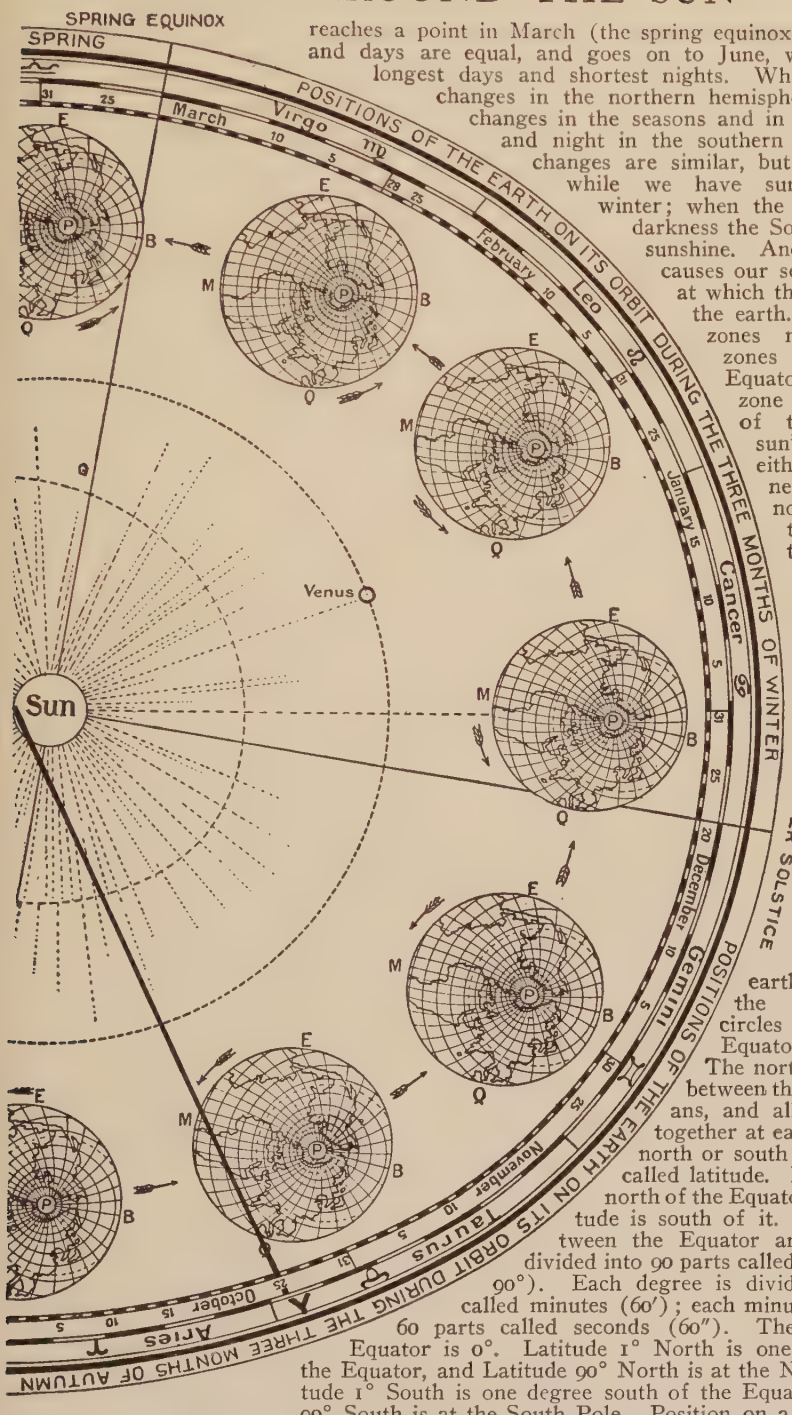
Here we are looking at a chart which shows the annual revolution of the earth around the sun. The object in the centre is the sun, and the different positions of the globes mark the course which the earth takes in its revolution. If you will notice carefully you will see that it is nearly circular, and this nearly circular path is called the earth's orbit. Never stopping for a second, the earth goes on and on swinging around the sun, which is 93,000,000 miles away from it. It takes 365 days, 5 hours, 48 minutes and 46 seconds to complete one revolution, and the time for this great journey is what fixes the length of one year. The earth has another motion. It is steadily turning, or rotating, about its own axis, and this motion has important results. In the first place, it causes day and night. Take a globe or a ball and turn it around in the sunlight and see how the light and shadow fall on it. The rotation of the earth makes the sun appear to rise and set, just as when we are in a moving railway train the objects that we pass appear to be moving in a direction opposite to that in which we are traveling, while we seem to be standing still. As we see the sun first in the east and last in the west, the earth must be turning from west to east; and as one turn takes twenty-four hours, we have a day of that length. The revolution of the earth around the sun causes the seasons, and its rotation on its own axis causes day and night. In the chart the lowest sphere, which has the date of September 23, shows the earth receiving the light of the sun from North Pole to South Pole. Day and night are equal everywhere on the earth (the equinoxes), and in this northern hemisphere where we live it marks the end of summer and the beginning of autumn. Following to the right, we find that as the months pass, the North Pole falls deeper and deeper into shadow until we reach December 21, when we have the longest night and the shortest day, and winter begins.



In the North the nights are longer still, and in the Arctic Circle there is continuous night for weeks. Continuing with the globes, the Pole emerges little by little from shadow,

In our chart the outer and inner rims give the seasons and months of the earth's journey round the sun. The middle rim is the ecliptic with the signs of the zodiac, of which you read on pages 3730 and 3731.

THE EARTH AROUND THE SUN



reaches a point in March (the spring equinox) when the nights and days are equal, and goes on to June, when we have the longest days and shortest nights. While we have these changes in the northern hemisphere there are also changes in the seasons and in the length of day and night in the southern hemisphere. The changes are similar, but exactly opposite: while we have summer they have winter; when the North Pole is in darkness the South Pole is in full sunshine. Another thing which causes our seasons is the slant at which the sun's rays strike the earth. There are three zones north and three zones south of the Equator. In the torrid zone north and south of the Equator the sun's rays are always either vertical or nearly so; in the north and south temperate zones they strike the earth at a greater slant; and in the frigid zones at a greater slant still. Thus the heat gets less and less as one goes away from the Equator. As you look at the globes you will see circles drawn about them and also lines passing from pole to pole. The Equator is the circle about the earth midway between the poles, and the circles parallel to the Equator are parallels. The north and south lines between the poles are meridians, and all meridians come together at each pole. Distance north or south of the Equator is called latitude. North Latitude is north of the Equator and South Latitude is south of it. The distance between the Equator and either pole is divided into 90 parts called degrees (written 90°). Each degree is divided into 60 parts called minutes (60′); each minute is divided into 60 parts called seconds (60″). The latitude of the Equator is 0°. Latitude 1° North is one degree north of the Equator, and Latitude 90° North is at the North Pole. Latitude 1° South is one degree south of the Equator, and Latitude 90° South is at the South Pole. Position on a parallel is shown by means of the meridians which cross it. The meridian that passes through Greenwich, England, where the British Royal Observatory was established in 1675, is usually chosen as the meridian 0°, from which distances east and west are reckoned.

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To find the zodiac constellation in which the sun is located, draw a line from the month and day, as X, through H, the ellipse centre, to the middle rim at Y. Thus XHY, drawn from April 25, ends in Taurus.

our imagination to realize through what a wonderful universe we are rushing.

Think, too, of the marvelous making of our little world. It is interesting to watch a sculptor making a figure out of marble, or to watch a painter putting trees and hills and faces on canvas; but on our journey through space we can watch a much more wonderful artist—we can watch the Creator's work of making suns and planets, and find out how this world came into being.

THE CLOUD THAT IS BEGINNING TO BE A SUN LIKE OURS

What we call empty space is not empty; it is full of an invisible wonderful something we call ether. It is this ether which conveys light to us, and tells us of the house across the street, of the suns millions of miles away, of the friend across the room. Now, at places in space something miraculous seems to be going on in the ether.

We see a glowing cloud, millions of miles in diameter, which has blossomed in the invisible ether. It certainly was not always there, and if it was not always there some Power must have made it. God made it. He is beginning to make it into a sun. When astronomers examine such a cloud with telescopes and spectroscopes, they discover that it is composed chiefly of the two gases, hydrogen and helium.

That does not seem very wonderful, but chemists have found that all the elements in the world are built up of atoms of these two light gases. In the cloud, hydrogen and helium are being prepared to make all the other elements that go to make suns and planets. At this stage the cloud is very thin, thinner even than the air we breathe; but as the gases form, and as new elements are constructed, the cloud contracts, or shrinks, and grows denser and hotter. The chemical processes going on, and the shrinking of the cloud, both produce great heat, and so the cloud becomes a blazing sun like ours.

THE WONDERFUL THOUGHT THAT SO MUCH CAME FROM SO LITTLE

But at a certain point the heat leaks away faster than it is formed, and the sun cools, and as it cools down, heavier elements are formed—the gases become partly fluid and partly solid.

We can see in space plenty of suns which have reached this stage, and the spectroscope shows that they contain numerous elements, including iron and other metals. In the cloudy stage, astronomers call the sun a giant sun, and in the more condensed stage, they call it a dwarf sun; and finally the dwarf sun cools down entirely and becomes a dead, dark sun.

That is a very brief sketch of how suns are made. But sometimes, while suns are contracting, their surface breaks up, and the fragments become planets revolving round it. Something of that sort happened to our sun; and the fragments grew into the planets, and one of the planets is our earth.

It is surely wonderful to think that the earth was made out of the invisible ether of space, and that at one time all its rocks and seas and animals and plants were nothing but hydrogen and helium gas! It is surely wonderful to think that a great Power could bring so much out of so little! And one of the most wonderful things in the making of the earth was the final steps that made life possible.

OUT OF THE FLAME AND FIRE CAME THE VERY THINGS LIFE WANTED

At first this big ball of ours was simply a globe without solidity and without life. As it contracted it formed a heavy crust, and as this crust cooled and solidified and condensed, it squeezed out slag as cooling iron in an iron-foundry does. This slag formed the early crust of the earth. And the amazing thing was that the crust contained iron and lime and sulphur and sodium and potassium—*just those elements which were necessary to life.*

EVERYTHING ON EARTH MADE AND PREPARED FOR MAN

Everything in this wonderful planet of ours seems to have been made for us, and, in wise, far-seeing ways, prepared for us. Think of glass, and what it means to us! Think what the microscope and telescope have revealed to us! Think what eyeglasses mean to so many! Yet silicon, the element essential for glass, was collected for us in sea-water by countless myriads of tiny sea-organisms which made of it little glassy shells, often of delicate beauty.

Wonderful changes have taken place in our world since it first became the home of living creatures. Its crust has been broken, and cracked and crumpled; its ocean beds have been puckered up into mountain ranges; continents have sunk beneath the seas. Most of the chalk of England was formed in the bottom of the sea; and the granite of Scotland is the remnants of mighty volcanoes. Even the Hima-

FROM SUCH A CLOUD OF FIRE CAME EARTH

The nebula of Andromeda as seen through the big telescope at the Yerkes Observatory in Wisconsin.

1. The earth is not flat, but round, like an orange. We know this by the way a ship comes into sight at sea.

2. At first we see only smoke. Then we see the top of the mast, as if the ship were climbing up a hill.

3. Then the bows appear, and we see the vessel rising higher and higher.

HOW WE KNOW THE EARTH IS ROUND

layas rose from the ocean; the Dolomites were once coral reefs; and many parts of the earth's surface have been alternately land and ocean floor. Earth has had its tropical periods, too, when great forests and jungles grew in the polar regions, and it has had its Ice Ages, when almost all Europe was under glaciers. It has had its Age of Insects, its Age of Reptiles, its Age of Mammals, its Age of Man.

Yet the earth has gone spinning round the sun, and evermore life has blossomed more richly. At first its most wonderful inhabitant, Man, hardly knew where he was, and it was many ages till he discovered that the earth was a round ball spinning on its axis and revolving round the sun. At first he naturally thought the earth was flat, and that the sun went round it; but bold men who sailed about the world proved it to be round, and other men discovered the revolution of the planets.

THE SPINNING OF THE EARTH AND WHAT IT GIVES US

The spinning of the earth on its axis is a very strange thing; but the sun also spins, and all the other planets spin, and it is probable that it has meanings we do not understand. But some of its uses to us we do understand; it gives us alternatives of day and night, which help us to divide our lives between activity and rest. It produces the tides, and it is the cause of some of the great regular winds which regulate and modify the climate of the earth.

The earth does not spin quite upright, but is inclined a little on its axis. This slanting of the earth as it revolves round the sun is the cause of the seasons in the north and south hemispheres. At one point in the earth's revolution the North Pole is leaning toward the sun and the South Pole away from it; and at another point in its revolution the South Pole is leaning toward the sun and the North Pole away from it; so we have summer and winter alternately in each of the two halves of the globe. During its revolution round the sun the earth turns on its axis almost exactly 365 times, and so the year has almost exactly 365 days.

THE BIT OF THE EARTH THAT BROKE OFF LONG AGO

When we are talking of the wonders of the world, we must not forget the moon, which revolves round it once every twenty-seven days. As the earth is supposed to be of the same substance as the sun, so

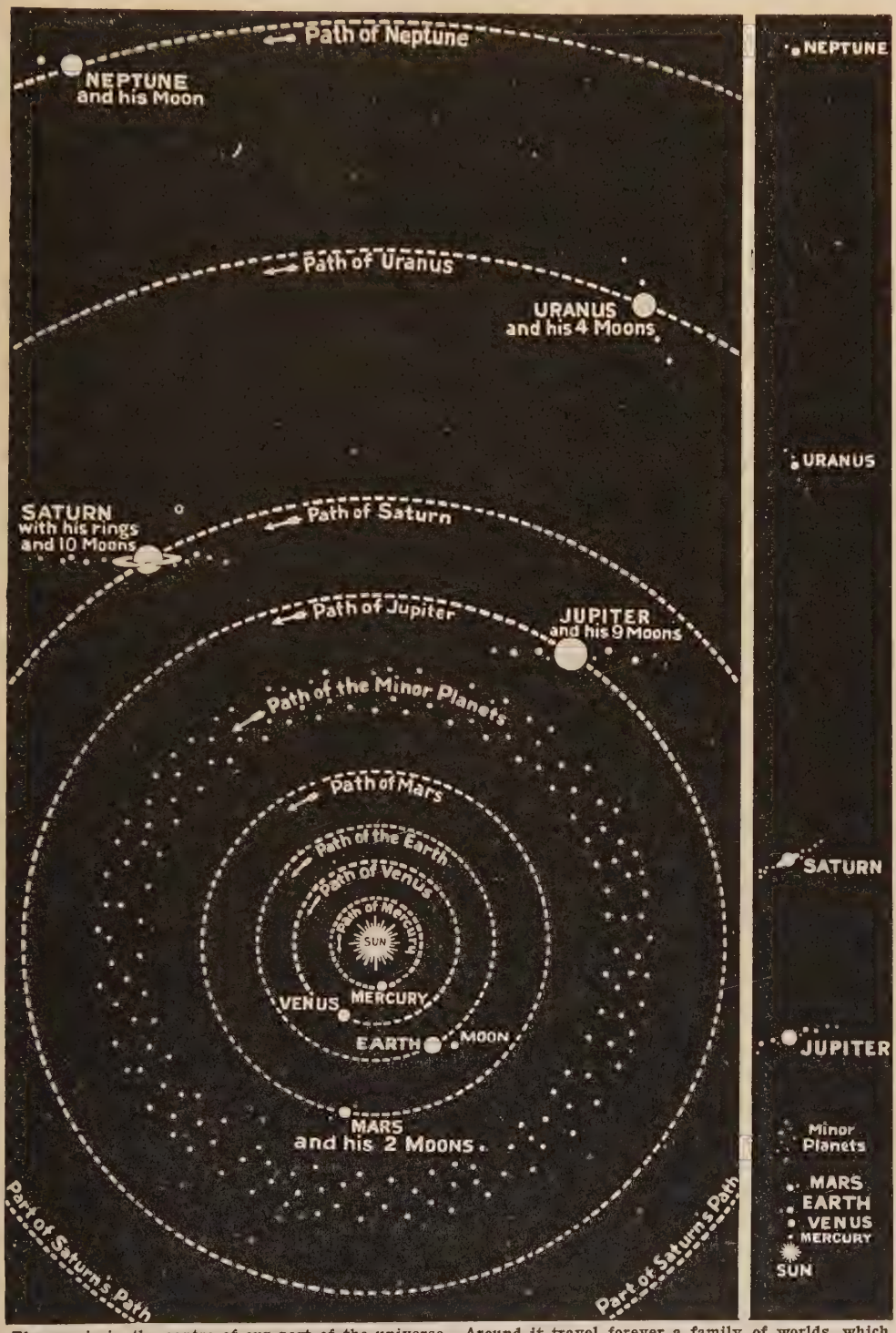
4. If the earth were flat we should see the whole ship at once, not the mast first and the rest bit by bit.

5. But we do not see it that way. We see the ship rising as if it were sailing up the other side of a ball.

6. At last the ship is over the circle, sailing clear on the top of the ball.

THE SHIP COMING UP THE HILL

THE SUN AND ITS FAR-AWAY WORLDS



The sun is in the centre of our part of the universe. Around it travel forever a family of worlds, which we call planets. The earth goes round the sun once in a year, but Neptune only six times in 1,000 years. At the right are the sizes of the planets compared with one another, and also their distance from the sun.

some think that the moon was torn off by the tug of the sun from the molten earth ages and ages ago. Even as the moon nowadays raises tides in the sea, so the sun in those ancient days raised tides in the half-molten metal as it whirled, and so a bit of the half-molten metal was partly whirled and partly tugged away, and went rushing round the earth, at first quite near it. Like the earth, it had great volcanoes spouting fire, and it must have been a splendid spectacle as it rushed round the earth dragging great molten tides after it.

In time this fragment of the earth got farther and farther from the earth, and in time it cooled down, and now it is like an enormous piece of dry slag covered with huge extinct volcanoes, and it keeps always the same side to the earth. But it is a very beautiful object in the sky.

Could there be a more marvelous world than this planet of ours, spinning on its axis and racing round the sun between Venus and Mars, with the silver moon shining on its oceans? There are bigger suns and planets than ours, but is there any with such a wonderful heritage of life?

And the earth is the home of mankind, full of beautiful and wonderful things. We are all rushing on, no man knows where, through the ocean of infinite space. We are spinning round a thousand miles an hour, we are revolving round the sun at eighteen miles a second, but so smooth is the motion that we feel neither the whirl nor the rush. On and on we go, and when the earth has revolved some seventy times round the sun, you, I, and each one of us, must go perhaps on a still longer and more wonderful journey. But while we are in the world, let us try to explore its wonders and understand it, seeing in all things the wisdom and love of God, who made us out of a few elements; and let us realize that, vast as is the universe, even so vast is the soul that has been given to us.

THE MOON THROUGH A BIG TELESCOPE

THE NEXT STORY OF THE EARTH IS ON PAGE 141.

THE PROCESSION OF THE WORLDS

This is what we should see if we could stand out in the universe and watch the great procession of the worlds that make up what we call the solar system. In the centre is the sun, 93 million miles away. Nearest to it is Mercury, then Venus, then our moon below the earth. Above the earth is Mars, on which there may be life; above is Jupiter, which perhaps has not yet cooled down; and at the top is Saturn.

BRIDGES ON BOTH SIDES OF THE WORLD

This picture shows a rustic wooden bridge of simple construction across a stream near Yoshiwara in Japan, with Fuji-yama's snowy peak rising beyond.

Fuji-yama seen from a different point of view has for a neighbor this iron bridge of the Japanese Government Railways which spans the Fuji River.

The Interstate Bridge over the Columbia River, completed in 1917, connects Washington and Oregon. It is a steel structure three-quarters of a mile long, made up of thirteen spans and piers. From bank to bank the bridge proper is 3,531 feet long.

Two upper photos, courtesy of "Japan"; third photo by Arthur M. Prentiss.

Photo, courtesy Pennsylvania Railroad.

The longest stone bridge in the world, over the Susquehanna River.

FOOTPATHS IN THE AIR

NO one can say who built the first bridge. Nature herself would no doubt be man's first teacher. Man would find a path across a chasm by clinging to a twisted vine; or he would see a ready-made bridge consisting of a fallen tree-trunk across a stream. Those were the first bridges, and they were the sort which would have to be made for hundreds of years.

One day a genius arose, who dumped high heaps of stone in a line across a stream, and on the top placed slabs of slate or stone or fallen trees. Then, a long, long while afterward, came bigger, real bridges. The Romans were the first to learn how to make these. They built splendid bridges on arches, some of which exist to-day.

Later people of other nations followed Roman models and built good bridges. The twelfth century had almost ended when the first great London Bridge was built. There were wooden houses and shops on it, but these were always catching fire and damaging the bridge, and they were all pulled down before the bridge was destroyed.

A great reform was made in bridge-building by John Rennie. It had been customary to make the arches very high, so that when a bridge had only one arch, the roadway sloped sharply up on one side and down on the other. But John Rennie made his arches, not like the half of a circle, but like the half of an egg cut lengthwise.

Though men know how to build stone bridges, many large timber bridges were built until recently. Some of them were very long and stood far above the water. One of the most famous was a bridge over the Connecticut River at Bellows Falls. Later a combination of iron and timber was used.

These iron and timber bridges were cheaper than iron or masonry, and many of them were built in Canada and the United States. As trains grew heavier, they were not quite equal to the task, and generally they were superseded by bridges of iron, steel or concrete. Large masonry bridges are so expensive to construct that few are now built except in cities where they serve as monuments as well as bridges.

When the eighteenth century was drawing to a close, men began to build bridges of cast-iron. But engineers soon found that, though cast-iron can bear great pressure, it will not bear much *pull*. It cannot be easily crushed by a weight, but it can soon be snapped by weights which pull at the two ends. So they then used wrought iron, which cannot easily be pulled apart. That served until steel came into use, in the nineteenth century.

The first great bridge built of wrought iron was the Britannia Bridge, which crosses the Menai Straits in North

Wales. The builder was Robert Stephenson, a son of George Stephenson. He made a huge square tube of iron—iron at the top, iron at the sides, iron at the bottom, and through this tube of iron the trains pass. To increase the strength of the bridge he made the iron at the top and bottom tube-shaped instead of solid, because it would better stand the pull of the weight.

THE GREAT IRON TUBES IN WHICH THE TRAIN CROSSES THE WATER

These tubes are placed on huge columns of masonry. One of them is built on an island halfway across the water, and the others on the land at the sides. As ships were constantly passing, it was impossible to put up great scaffolds on which to build up the ironwork. So Stephenson had the two tubes, nearly 500 yards long, built in four sections on shore. When all was ready, the big tubes were floated on many boats and ferried out to the towers.

There are many fine bridges supported by steel arches. The St. Louis Bridge has foundations resting on the solid rock 136 feet below high water. The largest bridge in Paris is the Pont Alexandre III over the Seine. The suspension bridge over the Niagara River built by J. A. Roebling in 1852–55 was considered a great success, but the increasing weight of railway trains had not been foreseen. In 1896–97 it was taken down, and a great steel-arch bridge was built in its stead.

One of the finest of all bridges is the great steel cantilever bridge. A cantilever is copied from the oldest of simple bridges. If two trees lean over the water from different sides of a stream, we have only to run a plank from the end of one trunk to the end of the other to make a simple cantilever bridge. That is one way of applying it. The other is to consider the cantilever a bracket. Secured firmly at one end, a bracket will bear a shelf with a heavy weight of books, and the steel cantilevers forming a bridge are merely huge brackets. A good example is the great Forth Bridge.

HOW THE GREAT FORTH BRIDGE WAS BUILT

For a long time the Forth Bridge was the finest cantilever bridge in the world, but it has now been surpassed by the Quebec Bridge, of which we shall say more in a moment. The Forth Bridge was designed by Sir John Fowler and Sir Benjamin Baker, who had a difficult task before them.

They had to cross two swift channels of water. There is an island in the middle, but on each side of it there flows a channel of water deep and swift and 1,700 feet broad. It was impossible to sink piers in these channels, so the central pier was founded on the island and two others built nearer the shores.

The cantilevers, of which there are three pairs, carry the bridge across the two wide stretches of water. They are each 1,360 feet long, and the three, stretching out toward each other, leave a space of 350 feet to be covered between the ends of the first and second, and a similar space between the ends of the second and third. Here ordinary steel girders are used. In order that ships may pass under it, the bridge is made 150 feet above high tide, and its top parts are 361 feet above the water.

HOW KITES AND ROCKETS ARE USED FOR BUILDING GREAT BRIDGES

The best suspension bridge in England is at Clifton. This is 702 feet across, and 31 feet wide. It is more than 200 feet above the river Avon, and it is said that the first string attached to the rope which pulled across the cable was sent over by a kite.

A still stranger way was adopted for starting the great bridge across the river Zambesi in South Africa. The bridge is the highest in the world—400 feet above the water—and runs from cliff to cliff; so they had to fire a rocket fastened to the end of a cord. The rocket took the cord across, the cord was used for hauling across a wire, and the wire was used to pull over a small cable. On this a truck crossed carrying the main cable of the bridge, which is 200 yards long and the greatest engineering wonder in South Africa.

The Tower Bridge in London is 800 feet long. When a ship is too high to pass under, great machines cause the roadway to open in the middle. The two halves are pulled up, working on enormous hinges, and the ship passes through.

The great city of New York has many bridges, but those that are best known are the four built over the East River, the stretch of water which separates Manhattan Island, on which the centre

of the city is built, from Long Island. Of these four bridges the most famous and indeed one of the most famous bridges in the world, is the one known as Brooklyn Bridge.

How the famous Brooklyn Bridge was built

This bridge was commenced by Mr. J. A. Roebling, who built the first suspension bridge over Niagara River. He was the first man to use wire cables, instead of chains, to suspend a bridge; and he used this plan for Brooklyn Bridge. Thousands of steel wires were used in each giant cable, by laying them parallel with one another over the tops of towers built on the land. The wires were clamped into nineteen strands for each cable and each strand contains nearly three hundred wires. The strands were then wrapped round and round with steel wire, to bind them into a cable, and at the same time form a flexible covering. After Mr. Roebling's death his son finished the bridge, whose airy grace gives little hint of its immense strength.

There are two other suspension bridges across the East River, and one of them, the Williamsburg Bridge, is peculiar because, instead of being covered by a winding wire, the wires of which the cables are formed are clamped together at regular intervals by bands of steel, from which the suspenders which support the roadway are hung. The sections made in this way are covered by steel plates which overlap like armor. The Manhattan Bridge, which is also a suspension bridge, is longer than either of the others, and can carry a much heavier load. However, it is not so graceful as the Brooklyn Bridge.

The Queensborough Bridge is a cantilever bridge, which is noted for the fact that the cantilevers do not carry a suspended span, but, as it were, lock arms over the water. This is possible because the engineer was able to build two piers on an island in the river.

A great steel arch which carries a railway

Another great bridge in New York is a railway bridge, which is part of a long viaduct that carries a railway from Long Island, across two islands in the river, on to the mainland. The bridge itself is an immense steel arch which spans a distance of a thousand feet across and carries four railway tracks 140 feet above high water. We gain some idea of its size when we are told that it cost over $10,000 to drive in the rivets that hold its beams together. These beams are seven feet across; some are ten and a half feet deep.

Instead of running along on top of the arch, the roadway of this bridge runs underneath it. Heavy girders are used to suspend the roadway from the arch, and these not only carry the weight but help to stiffen the whole bridge against the force of the winds that swirl down through the narrow end of Long Island Sound.

The longest cantilever bridge in the world

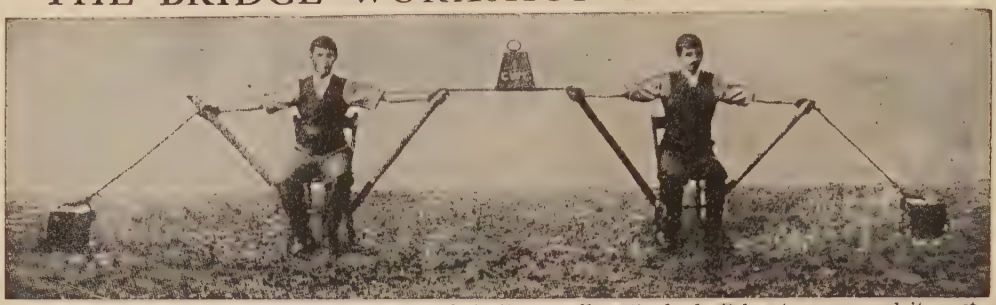
The Quebec Bridge already mentioned, which connects the north and south shores of the St. Lawrence River at Quebec, is the longest cantilever bridge in the world. Its main span is 1,800 feet in length, its central span is 88 feet wide, 110 feet deep and 640 feet in length, and weighs over 5,000 tons.

The building of this bridge was successfully completed in September, 1917, but only after two disastrous failures. After many years of effort, in 1907 when the half of the bridge on the southerly side was nearing completion, it collapsed under its own weight, drowning 82 of the bridge crew working on the structure. Not only the cantilevers, but the centre span as well, had been constructed by the overhang method. A special board was appointed to investigate the matter, with the result that an entirely new bridge was built, and in 1916 an attempt was made to raise the central span. It had been raised but a few feet when, in the presence of great crowds of guests, one corner slipped off the girder, and under the great stress it broke up and the whole structure fell to the bottom of the St. Lawrence.

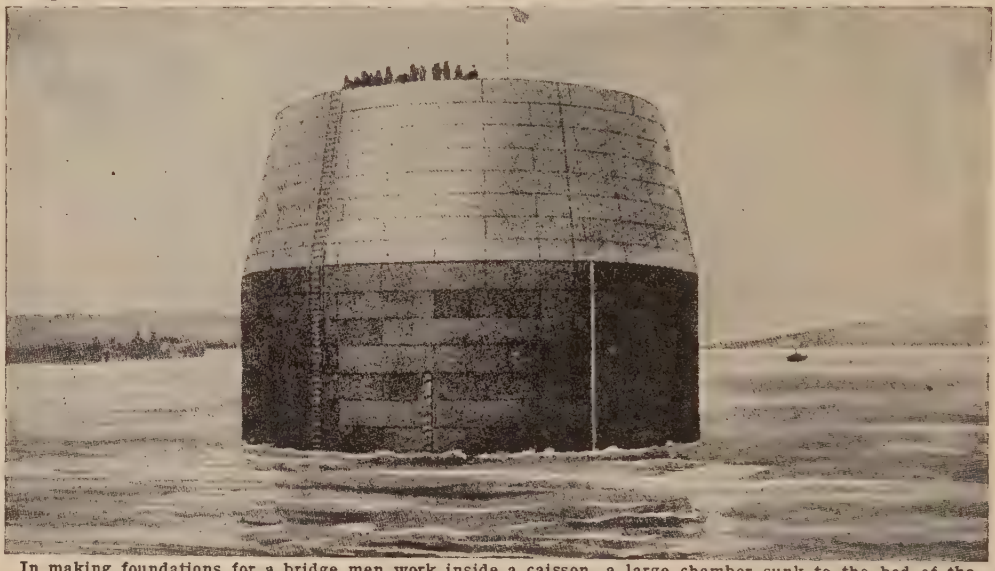
It was immediately decided to build a new span, and great care was taken to avoid the mistakes which had caused the previous accidents. The span was an exact duplicate of the one that was lost, and had been finished in less than a year. In September, 1917, the span was floated into position, and on the third day it was pinned in place high above the river. Recently many great bridges have been made of concrete in which steel rods or girders have been placed.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 167.

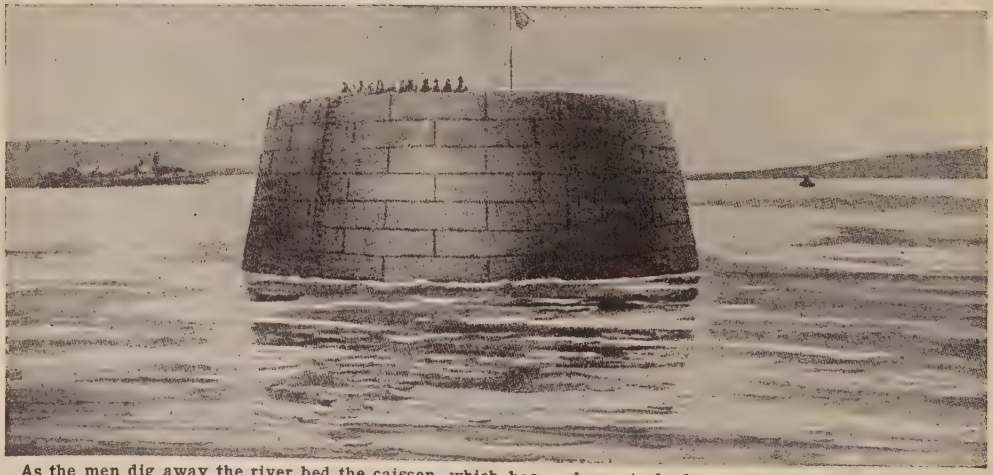
THE BRIDGE WORKSHOP IN THE RIVER



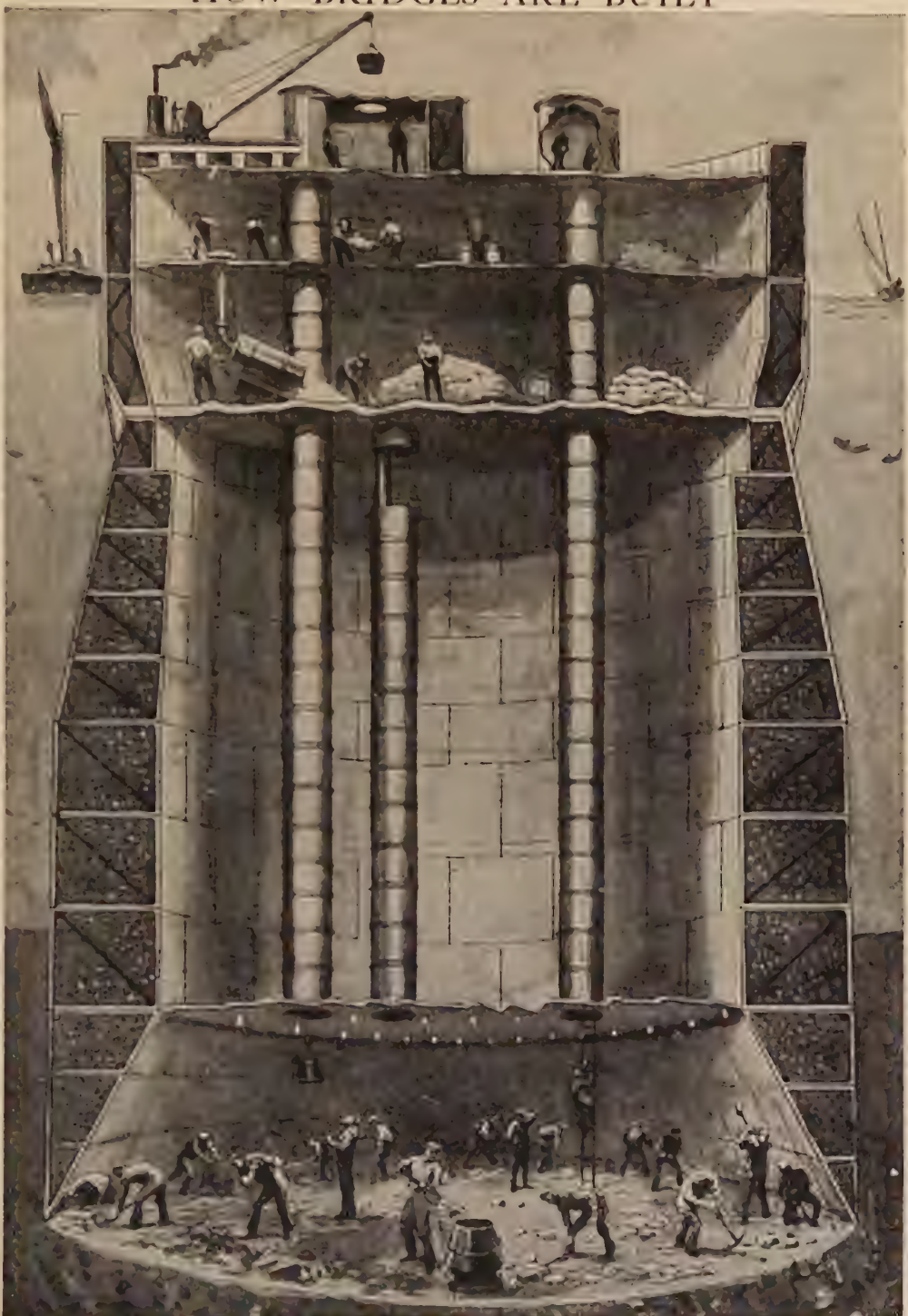
A bridge must support the weight of the materials in it, as well as the loads it has to carry, and it must withstand snow, wind and storms. What we call the cantilever is simply an overhanging bracket which would tend to overturn; but if two cantilevers are built out from opposite sides, they will counterbalance one another. Each of the sitting men here represents a double cantilever. The outer sticks are tied to weights and cannot collapse inward, and the inner sticks support a weight which is equally distributed.



In making foundations for a bridge men work inside a caisson, a large chamber sunk to the bed of the river. This picture shows a caisson 70 feet wide, built of stout wrought-iron plates, in position at the Forth Bridge. At the bottom is a working chamber lighted by electricity and filled with compressed air.



As the men dig away the river bed the caisson, which has a sharp steel edge at the bottom, sinks into it.



The Forth men worked inside the caisson shown on page 30. Mud was dilated with water and blown out by compressed air; clay was hauled out, and when a firm foundation was reached, nearly 90 feet below water level, the caisson was filled with concrete, and on this solid base the massive stones of each pier were laid.

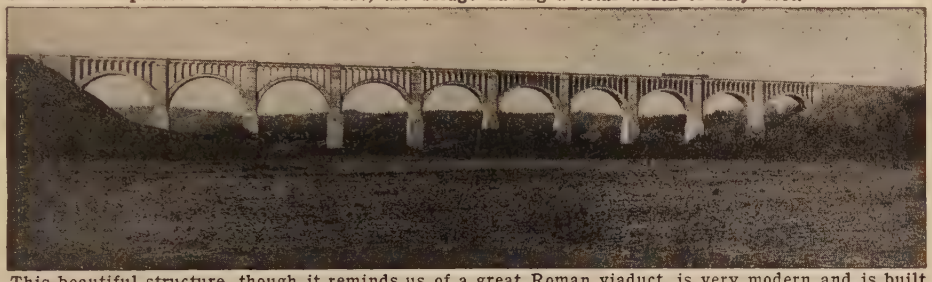
BEGINNING OF THE FORTH BRIDGE

The Forth Bridge, designed by John Fowler and Benjamin Baker, marked an epoch in bridge-building. Over 1½ miles in length, it took seven years to build and cost nearly $15,000,000. Three main piers, each consisting of four masonry supports built upon a caisson, carried pillars of hollow steel 360 feet high.

From these pillars the bridge was gradually built out. Over 50,000 tons of steel and 140,000 cubic yards of concrete and masonry were used. The openings have each a span of nearly one-third of a mile.

BRIDGES OVER RIVER AND VALLEY

The Peace Bridge over Niagara River from Fort Porter, Buffalo, New York, to Fort Erie, Ontario, commemorating a century of peace between Canada and the United States, was opened in 1927. Five steel arches span the river, and a clearance of 100 feet is allowed for the ship canal. Including approaches the length is 4,250 feet. The roadway is broad enough for four vehicles abreast with a sidewalk for pedestrians on either side, the bridge having a total width of fifty feet.



This beautiful structure, though it reminds us of a great Roman viaduct, is very modern and is built of concrete and steel. It is a viaduct built to carry a railway across the valley of the Tunkhannock creek in the Pennsylvania hills. The structure is 2,375 feet long, and at the lowest point of the valley the bridge is 240 feet high, while the foundations go down 60 feet more to reach the rock.

This unusual-looking bridge is one of the great railway bridges across the Elbe at Hamburg. The double arches are designed to give the bridge the strength needed to carry the immense traffic that comes to this port. No ships pass under this bridge, and therefore it is built low down over the water.

Photos in these pages, G. W. Wilson & Co., Wilson Bros., Valentine, Notman, Delaware & Lackawanna Railroad, Pennsylvania Railroad, Canadian Pacific Railway Co., Kinsey Realty Company.

THREE NOTABLE BRIDGES

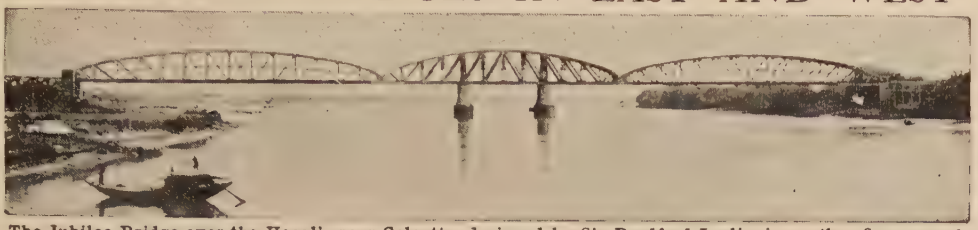
Brooklyn Bridge at the time it was opened, in 1883, had the longest existing bridge-span. It is a suspension bridge with a main span of 1,595½ feet, at 133 feet above the East River.

The bridge over the Delaware River connecting Philadelphia, Pennsylvania, and Camden, New Jersey, is the longest suspension bridge in the world, the main span being 1,750 feet long, 135 feet above water-level.

© Ewing Galloway.

The Hell Gate Bridge, a great railway bridge in New York City, lies across Long Island Sound, linking New England with the southern states. It is the longest steel-arch bridge in the world, the distance between the piers being 1,017 feet. It is part of a long viaduct, seen in the background here.

FOUR FINE BRIDGES IN EAST AND WEST



The Jubilee Bridge over the Hoogli, near Calcutta, designed by Sir Bradford Leslie, is another fine example of railway bridges. The central double cantilever is 360 feet long, and the two girders are 420 feet long.

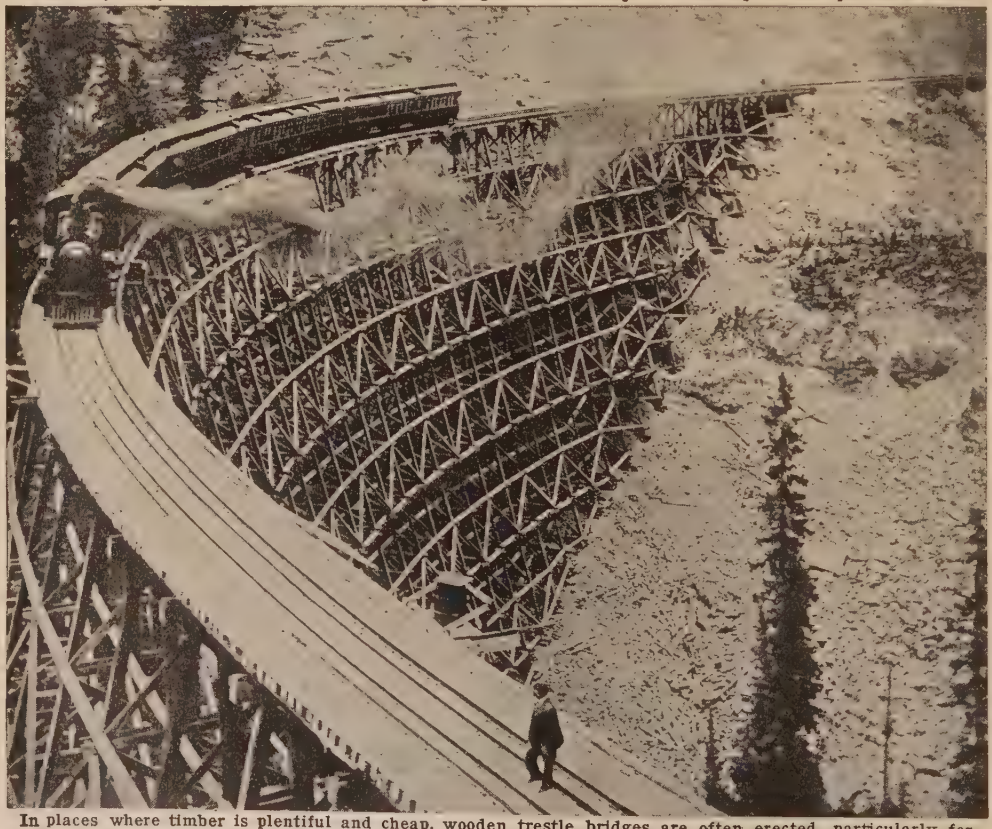
The Tower Bridge is the river gateway to London. It is 940 feet long, and when a big ship must pass, machinery raises the roadway, leaving a space 200 feet wide and 141 feet high. There is a footpath on top.

The Victoria Bridge crossing the St. Lawrence at Montreal was built round an old tubular bridge which was gradually removed. It is 6,592 feet long, has 25 spans, and cost $2,000,000.

The Tay Bridge, near Dundee, is two miles long and carries two lines of railway. It has 74 spans. Those in the centre allow a clear 79 feet for the passage of ships. It cost $3,300,000. The first Tay Bridge collapsed.

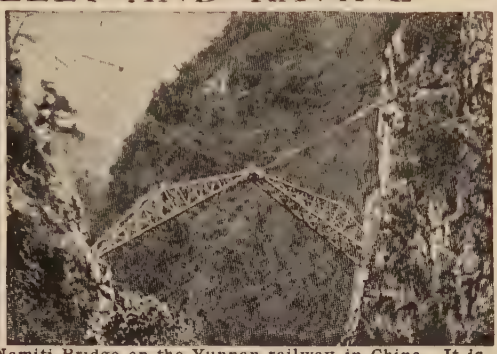
THE TRANSPORTER AND THE TRESTLE BRIDGE

On transporter bridges foot-passengers and vehicles are carried across in an inclosed car suspended by steel wire ropes from a trolley running on rails on the under-side of the bridge and worked electrically. A car may carry about six vehicles and 300 passengers at each trip. On the top is the operator's cabin.

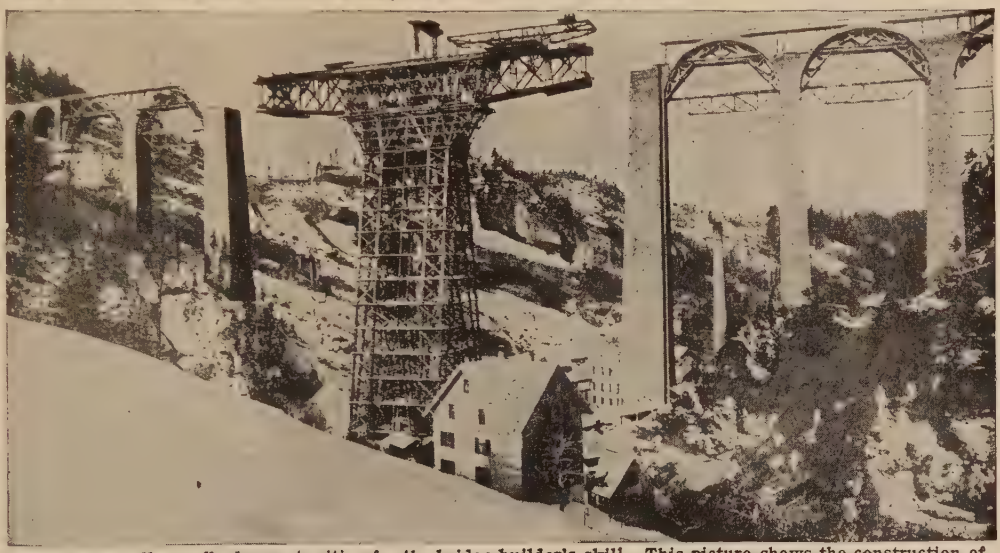


In places where timber is plentiful and cheap, wooden trestle bridges are often erected, particularly for railway purposes. The picture shows a bridge near Penticton, British Columbia, on the Canadian Pacific Railway. Such bridges are very serviceable and easily erected, but there is a certain danger from fire.

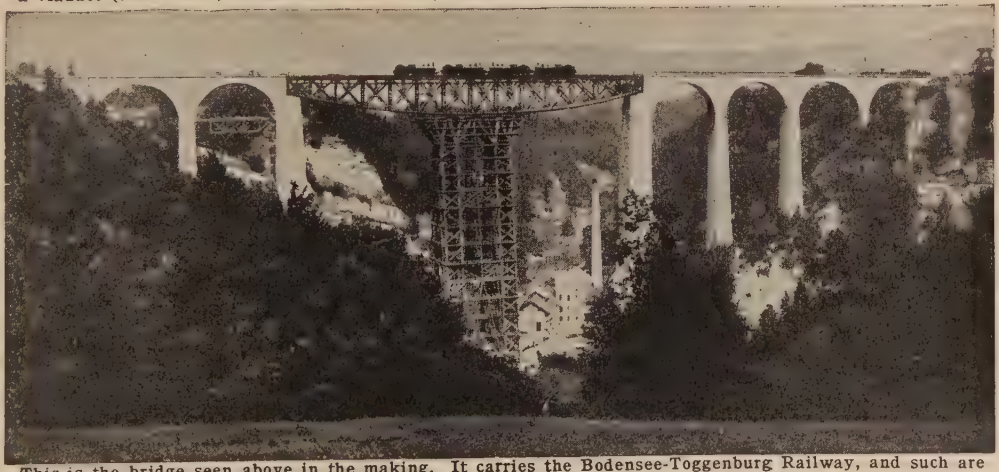
BRIDGES OVER VALLEY AND RAVINE



A bridge of somewhat novel appearance is the Faux-Namiti Bridge on the Yunnan railway in China. It is 220 feet long, spans a wedge-shaped fissure 350 feet above the water, and is approached on each side through a tunnel. In building it a bascule was lowered from each cliff-face by cables and winches, as seen in the first picture. With these bascules as supports the railroad was laid across.



The Swiss valleys afford opportunities for the bridge-builder's skill. This picture shows the construction of a viaduct (seen below) across the Sitter valley, near St. Gall, Switzerland, with scaffolding 300 feet high.



This is the bridge seen above in the making. It carries the Bodensee-Toggenburg Railway, and such are its graceful proportions that it does not spoil the beauty of the mountain valley seen through its arches.

BUILDING THE WORLD'S HIGHEST BRIDGE

Spanning the Zambesi Gorge, 400 yards below the Victoria Falls in Rhodesia, in the heart of magnificent country, is the highest bridge in the world. It is 420 feet above the water and 650 feet long. The arch hidden among the trees has a span of 500 feet. It was designed by Sir Douglas Fox and completed in 1905.

A rope was sent across the gorge by rocket and a cable was hauled across. Then work was begun, and here one side is beginning to reach out.

Bridge-building is perilous work. The men work at great heights with little foothold, and here we see a device to save them from falling into the torrent.

Building is carried on from both sides until the minute calculations of the engineers bring the ends together with beautiful exactness. Looking upward, we see that the chasm has finally been spanned.

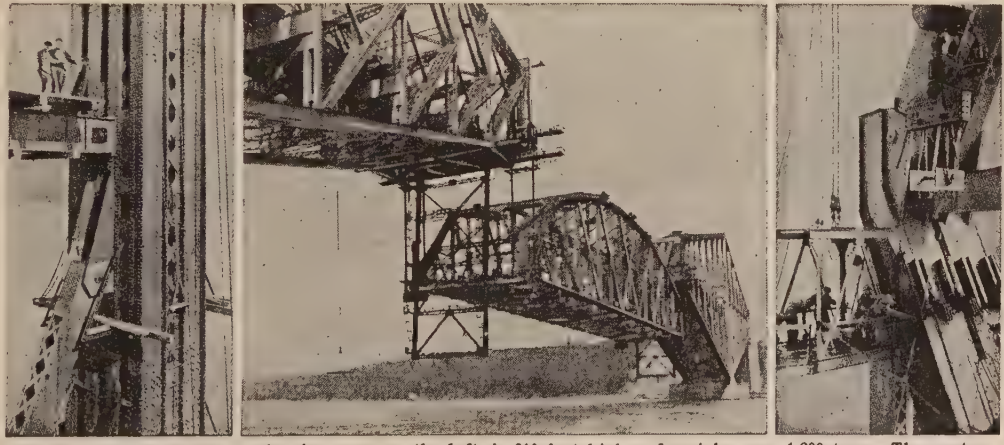
Here is the single-span girder bridge finished, a thing of graceful beauty and an important link in the great railway, the dream of Cecil Rhodes, that some day will run from the Cape to Cairo.

Photos, courtesy of the High Commissioner for the Union of South Africa.

BUILDING THE QUEBEC BRIDGE

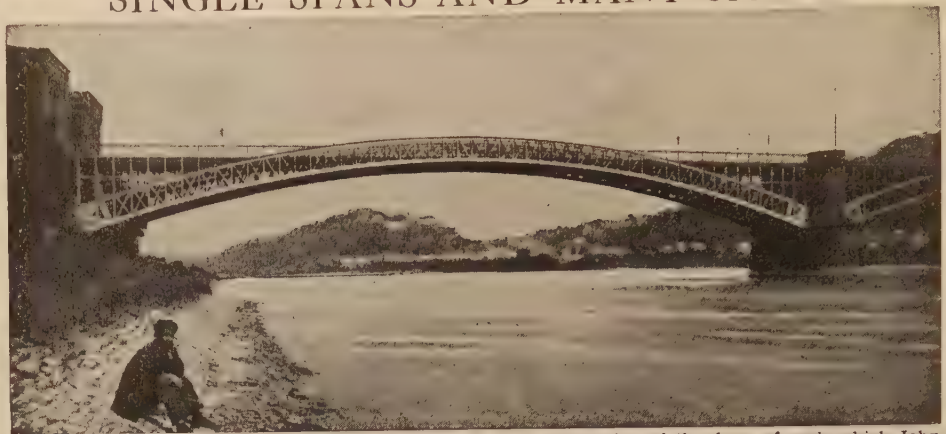
Quebec Bridge, carrying the Canadian National Railways across the St. Lawrence, was completed in 1917 after much trouble. In 1907 half the bridge collapsed; in 1916 the great central span, when being hoisted, fell into the river. 66,480 tons of steel and 8,000,000 rivets were used in the bridge, which cost $20,000,000.

The span from pier to pier is 1,800 feet, exceeding the Forth Bridge by over 100 feet, and the railway tracks are 150 feet above water. This picture shows the upper chord eyebars being hoisted into position.



The large post over the main pier, seen on the left, is 310 feet high and weighs over 1,200 tons. The centre span, 640 feet long and weighing 5,000 tons, was erected on pontoons and towed to the bridge by tugs; it took four days to raise it. On the right, workmen are connecting the first panel of the cantilever arms.

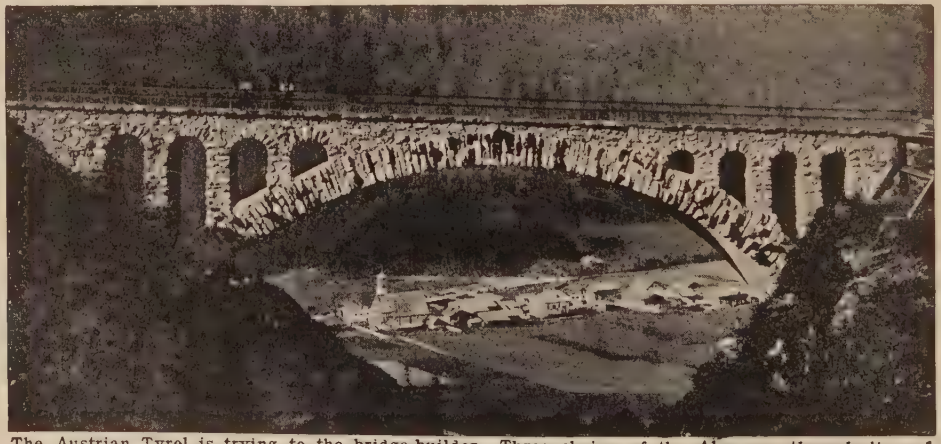
SINGLE SPANS AND MANY SPANS



The bridge across the Rhine at Coblenz, Prussia, shows us the value of the form of arch which John Rennie first used. Although we have only one great span here, the roadway is practically flat—not steep, as those over the old single-arch bridges were. The arch is shaped like half an egg.

* The Marble Bridge at Peking is famous, but its sixteen arches impede traffic in the river and make the roadway steep. We can all see the difference between this and Coblenz River.

New Brunswick has a copy of Clifton's suspension bridge. It crosses the Grand Falls at a giddy height, and looks, in the distance, like a spider's web. We see a vehicle passing over it.

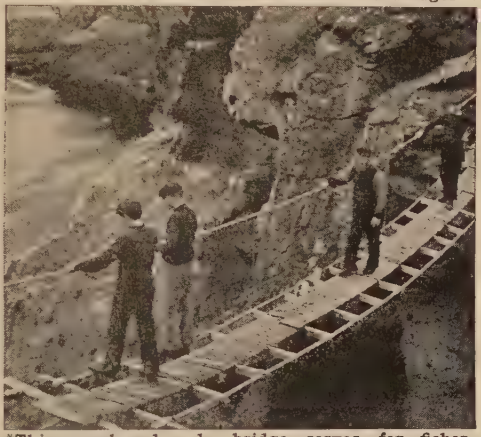


The Austrian Tyrol is trying to the bridge-builder. Three chains of the Alps run through it, and gorges and chasms must be crossed where the railways run, as we see here at Waldi Tora. This bridge is of solid stone and has a single span, and harmonizes with the rugged grandeur of the scene. The village is below. There the natives live the old life, while the new life passes over their heads.

* © Underwood & Underwood, New York.

OLD-FASHIONED PATHS IN THE AIR

This picture gives an idea of what bridges were once like. Here is one built on piers made of logs. On top there is a roadway of timber. This bridge is at Sringar, the beautiful old capital of Cashmere, Northern India. The houses recall the bridges of old-time London with their shops and dwellings.



*This rough-and-ready bridge serves for fishermen to pass to a rock off the coast of Antrim, Ireland. It consists only of strong ropes and staves of wood. In stormy weather it sways.

*This bridge is made up of three ropes, two of which serve as hand rails and the third as the footpath. It crosses a river in India, which has many such suspension bridges.

In this type of big bridge the single arch and cantilever are not used. It is the Iwakuni Bridge in Japan, a bridge of wood and stone, in four spans. Only small ships can pass under it, and the roadway is as steep as a switchback ladder, and is furnished with 200 steps. Horses and carts cannot go over it.

*© Underwood & Underwood, New York.

WHEN THE WORLD BECAME KNOWN

Known world in 325 B.C.

Known world in 300 A.D.

1000 A.D.

1500 A.D.

1600 A.D.

1700 A.D.

1800 A.D.

To-day.

THE WORLD AS KNOWN IN EIGHT PERIODS IN HISTORY. KNOWN LAND IS SHOWN IN BLACK

WHAT THIS STORY TELLS US

THIS wide world, 8,000 miles in diameter and 25,000 miles round, with over fifty million square miles of land and twice as much water, is the home of 1,800 million people. Some of them are crammed up in great cities; some are scattered here and there with vast spaces all around them. London, with about a hundred square miles to live on, has more people than all Australia, with its five million square miles to live on. There are still forests and deserts that keep back population, but rarely do we find a spot on earth that is not home, sweet home, to somebody. Which way is the world going? Backward or forward? Once more war has thrown the world back and plunged it into evil and disaster, but we who make this book believe that still the world will go forward. Here we see the life of the peoples who share the world with us.

THIS GREAT WORLD OF OURS

ONCE upon a time in the not very distant past of our ancestors, there was no such word as "world." They used two words meaning "man" and "age." When they did at last run these two into one, making it presently our own familiar word "world," they meant by it *an age of man.* They never used it to suggest the whole earth, as we do now.

It is in this ancient sense that we will now speak of the world—our world, the world composed of living men, women and children in every corner of the earth, the rich and various humanity of this planet circling round the flaming sun.

What is it that first strikes us as we look at our world? Is it the difference which exists in speech, the difference which shows in dress, the differences which mark one nation from another in complexion and size? No; something much more difficult to understand.

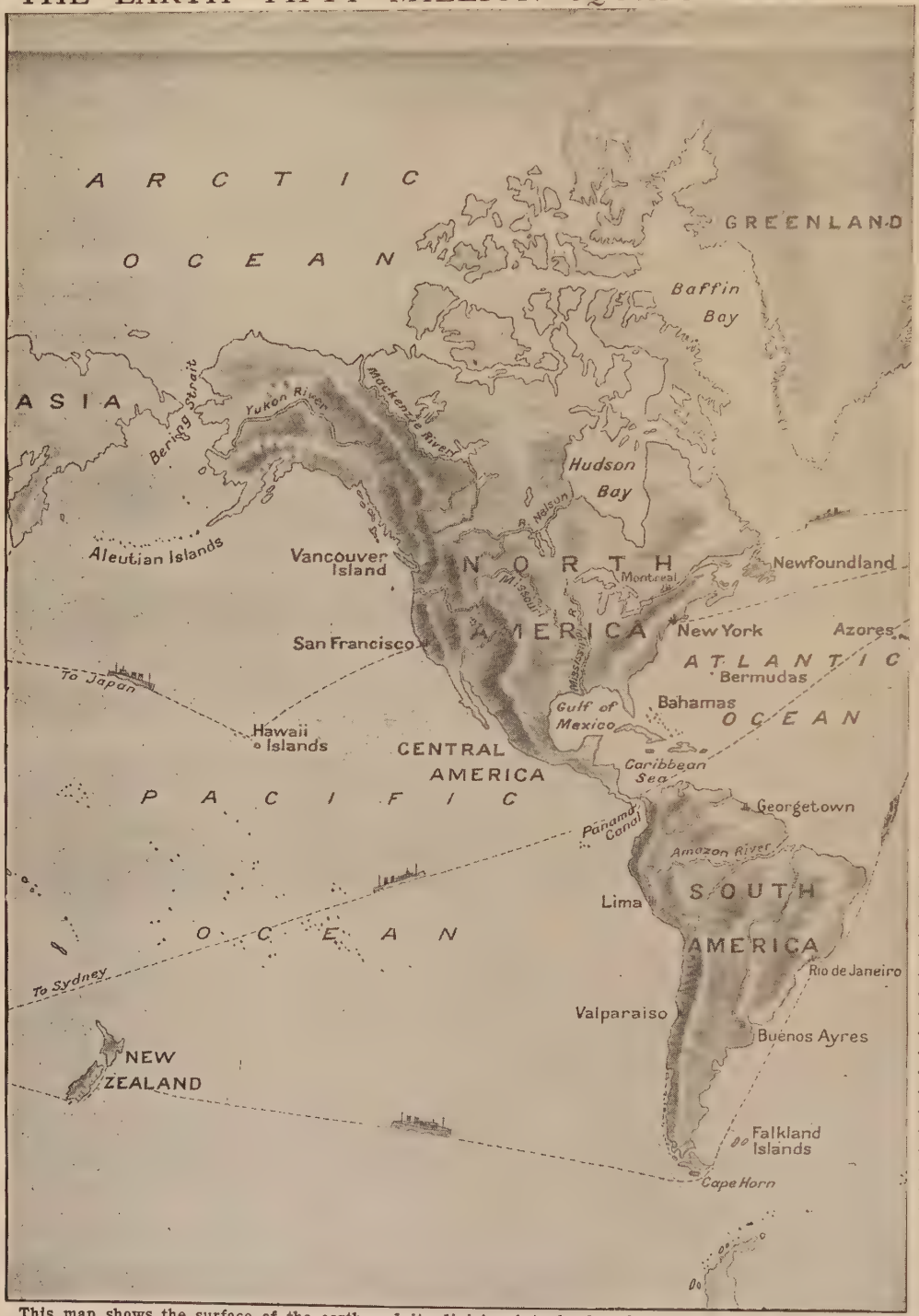
The first thing to strike us in looking at the inhabitants of the earth is the extraordinary distances which separate the various peoples *in time.*

It is the same hour for the whole earth. For the history of the entire planet, it is the twentieth century since the time of Jesus. And yet look at the vast time-distances which separate the French mathematician from the Laplander, the American inventor from the American Indian, the German chemist from the African negro, the English engineer from the peasant of Egypt.

The age of the earth is the same for all the world, and Asia was civilized many centuries before Europe; yet at the westernmost parts of Europe, so lately barbarian, we see more science, more art, more refinement in morals and manners than in the very heart and centre of the once regal East—the East of Babylonia, Assyria and Greece.

At once, then, we learn to be careful how we speak of the world. It is absurd, and it is also dangerous, to speak of the world as if it were a body of people all marching together on one road toward one definite goal. It is absurd to speak of the present as if it were the same for all the world, or of the past as if all the world had done with it and was pressing forward to one future for all mankind. We must speak of the world as a long chain of humanity which stretches from the very beginnings of human history up to this fleeting moment.

THE EARTH—FIFTY MILLION SQUARE MILES OF



This map shows the surface of the earth and its division into land and water. The Polar land boundaries have not been finally mapped, but the whole surface of the earth is about 197 million square miles, of which about 57 millions are land. Europe has 3,750,000 square miles, and a population of 400 millions. Asia is four and a half times as large, with 900 millions. Africa is three times the size of Europe, with 180

LAND ON WHICH 1,600 MILLION PEOPLE LIVE

million people. North and South America are four times the size of Europe, and have about 160 million people. Oceania, including Australia, is nearly as large as Europe, but has only one-fiftieth as many people. The oceans, covering about 140 million square miles, occupy over 80 per cent of the southern half of the world. The Pacific covers nearly 64 million square miles, the Atlantic about half as many.

This moment even now is flashing onward into the future.

We are reminded of that old story of a traveler through Time, told in a book seven hundred years old.

In passing one day by a very ancient and extremely populous city, I asked one of the inhabitants who founded the place. He replied: "I know not; and our ancestors knew no more than we do on this point." Five hundred years afterwards, passing by the same place, I could not perceive a trace of the city. Inquiring of one of the peasants when it was that the city was destroyed, he answered me: "What an odd question! This country has never been other than you see it now." I returned there after another five hundred years and I found a sea. I now asked the fisherman how long it was since their country became a sea, and he replied that I ought to know it had always been a sea. I returned again after five hundred years; the sea had disappeared, and it was now dry land. No one knew what had become of the sea, or if such a thing had ever existed. Finally, I returned once more after five hundred years, and found again a flourishing city. The people told me that the origin of their city was lost in the night of time.

So Time covers up the history of men.

EVERY NATION HAS ITS GOOD MEN AND ITS BAD MEN

But there is another way in which time enters into our view of the world. Each country is composed of people who are living at different points in this chain—people whose mental clocks are all striking a different hour.

One of the greatest of thinkers said that he did not know the way in which to draw up a statement against a whole nation. It can never be done. Each nation has its savages, its barbarians, its half-civilized and its civilized. Each nation drags the same world-chain on its journey to the future. There are saints in India and criminals in England. There are philosophers in China and ignorant people in Germany. There are geniuses in Arabia and brainless men in America.

We see, then, that the difference of all differences in this great world is one of time; and when we ask what we mean by time in this sense, we discover that it is a question of intelligence. To be a savage is to be near the starting-post of life. To be an educated and law-abiding person is to have run some part of the race through time. To be a genius or a saint is to be in some respects nearing the goal.

There was genuine inspiration in the lines of old Andrew Marvell:

The world in all doth but two nations bear;
The Good, the Bad; and these mixed everywhere.

Indeed, the whole business of politics, philosophy and religion lies now in getting the good to act together as one nation, not to crush and destroy the bad, but to encourage them to travel a little faster. It is because the world is marching out of step, and at such different paces, that we get confusion and the constant threat of war.

THE HOME OF SIXTEEN HUNDRED MILLION HUMAN LIVES

We shall notice many other interesting differences when we come to visit all the countries of the earth in this book. No nation will show us the same picture. Each country to which we travel in thought will tell us a tale told by no other. Every people will speak to us in a tongue quite different from the rest.

We shall be looking at the details of a tremendous canvas, at particular threads in a long tapestry, at small fragments in a vast mosaic. We shall have to remind ourselves from time to time of the thing as a whole—not of France, not of Italy, not of Japan, not of Mauritius—but of the world.

This mighty world consists of some 1,600 million human beings. It is divided up into a hundred nations, or peoples. Here it spreads itself over an enormous space and calls itself India. Here it creeps away into a little corner of snow-capped mountains and calls itself Scandinavia or Switzerland. Here it swarms over a fierce and desolate territory and calls itself Russia. Here it captures a few little islands and calls itself England.

THE VAST AREAS OF THE WORLD THAT WE SHALL SEE

At one point, as in China or Japan, this world is so crowded that the very roadsides must be cultivated for food; at another point, as in Australia, every man has a square mile to himself. We shall visit the prairies of Canada, the tropical forests of the West Indies, the sultry streets of Spain, the frozen peaks of Caucasus, the sandy wastes of Arabia, the domestic calm of Holland, the mighty waters and far-stretching deserts of Africa, the storied cities of France, the rocky fastnesses of the Balkan peoples, the one-time empire of Austria, the slumbering islands of the South Sea, the shores of Portugal and the lovely realm of Italy.

But what will specially interest us in this grand tour, this journey round the world, is the present condition of the human mind. We shall see the average person in each country moving before our eyes in one direction or another.

THE MEMBERS OF THE BIG WORLD-FAMILY WE SHALL MEET

We shall see the odd little figure of the Chinaman awakening from his sleep; the German building a new world on the ruins of an old; the Frenchman loving art and following the path of strict logic; the Italian turning from the monuments of a past of unrivaled glory to the factory of modern industry, a future of trade and commerce.

We shall see the industrious Norwegian harnessing his tumbling waters to the service of man, and the Russian suffering all kinds of inconvenience and privation under a new system of government. We shall find the Englishman digging his garden, building his ships and spinning his cotton; and the Australian riding after his sheep. We shall wander where the Hindu is at last being stirred to new thought, and the Cingalese diving for pearls and picking leaves from the tea plant.

We shall see the Spaniard indolently waiting for a sign; the Mexican flaming into sudden passion; the Hollander smoking his pipe on the side of a canal or in the midst of acres of tulips; the men of our own country ceaselessly making new things to lift the load of labor from mankind.

The discoveries and inventions of the nineteenth century have so improved means of travel and communication that no country now will be left to itself, to make its own slow way along the path of progress. Outside influence will come to bear upon trade, customs, language and thought, and travelers going in and out of a country will form links with other lands.

WHILE A CHILD AND WHILE A FLOWER IS BORN, THE WORLD IS YOUNG

And when we have seen all these things, and thought about them, we shall be able to form an opinion as to whether the world will get over its present crisis without final and complete disaster. We shall have, as well, at least some notion as to the spirit in which mankind should face the crisis that war has brought about for us all.

We shall see quite clearly that one nation cannot suffer want and woe without inflicting want and woe on other nations. We shall see that, while nations live like wolves and vultures, there will always be suffering on the earth. We shall realize that until they all work together, as the wheat with the soil, and the bee with the flower, and the rivers with the sea, there can be no lasting peace on this planet, and no lasting security for human life.

And, however dark seems the future, we shall learn from the troubled past that, so long as the good strive nobly and earnestly forward, the bad can never drag us right back to the past;

For a while a youth is lost in soaring thought,
And while a maid grows sweet and beautiful,
And while a spring-tide coming lights the South,
And while a child and while a flower is born,
And while one wrong cries for redress and finds
A soul to answer, still the world is young.

So the present generation, if it have faith, if it have courage, if it have a clear conviction of the one far-off divine event to which the whole Creation moves, may be able to break down the madness of war, the wickedness of jealous rivalry, and help to carry the world over its present danger and through this present night of tempest.

And so on to the end (and the end draws nearer),
When our souls may be freer, our senses clearer
('Tis an old-world creed which is nigh forgot),
When the eyes of the sleepers may waken in wonder,
And hearts may be joined that were riven asunder,
And Time and Love shall be merged—in what?

IF LOVE IS THE WAY, LOVE MUST BE THE END

None of us knows what will come at the end of this life; but if love is the way, love must be the end. At least we may be certain of this—that intelligence makes for love, and that in all the nations of the world the good are those who believe in love as the only way out of human difficulties. No prouder boast can be uttered by the human soul than that which claims kinship with the Mind of God in the universe, and says:

On Earth there is nothing great but Man,
In Man there is nothing great but Mind.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 421.

HOW WE GET ABOUT THE WORLD—TRANSPORT BY LAND AND SEA

HERE OUR ARTIST HAS PICTURED THE MEANS OF TRAVEL CHARACTERISTIC OF EACH COUNTRY

WHAT THIS STORY TELLS US

WHEN Life came in the world no man can tell. The first living things were very simple, and after these all the life we know has come. This part of our book tells us what we know of life, and how it works, and the most marvelous things it has made—the bodies we live in. Fearfully and wonderfully are we made, and perfect and beautiful beyond words is the human frame and all that moves within it. Here we shall read how it works, of the astonishing arrangements which govern our lives, of the delicate balancing of the machinery which secures the perfect working of sight, thought, speech, hearing, breathing, moving; of the complete co-operation and sympathy existing in us all between body, mind and soul, and we shall read of our place in the world.

LIFE THAT FILLS THE EARTH

LIFE fills the seas, covers the dry land, and flies in the air above. Everywhere in all the world we know there is life and movement and birth and death and new birth; always and everywhere there is life and more life of many kinds.

These are some of the most interesting and important facts about the great world in which we are now living, and there are many questions you will surely ask concerning them. For instance, what is the difference between a living thing, like a rose or a fly or a child, and a thing that is either not living now or never has lived, like a stick or a piece of coal or the clay in the garden or the pavement under our feet? What is really the difference? An elephant is very different from a blade of grass or a tree, yet an elephant is much more like the grass or the tree than it is like a piece of flint or a grain of sand. Why do we say that this is true?

We know that living creatures die, and yet Life does not die; there is no living thing on the earth now that was alive two thousand years ago, except, perhaps, a few great trees in California or Lebanon. All the living things that were alive then—fishes and flies and birds and flowers—are dead now; yet the earth never was so filled with life as now.

Why is it? It is because of the very wonderful fact that all living things have children, that these children are like their parents, and that when the parents die the children carry on their lives. The plant produces seeds and if we plant these seeds they grow into plants very like their parents. The chicken, the colt or the child will grow to resemble its parents also. So, though the parents may live only a very short time, their children take their places; and so the world goes round.

There is an old Greek story of the runners who had to carry a flaming torch, and, as one runner fell, tired out, he gave the torch to another; and so, though the runners fell and could not reach the goal, the torch was not put out, but went on burning. The torch is like the flame of life.

Where have all these living things come from? We know that all things, living and dead, have come from God, who sustains them from everlasting to everlasting, but how did all these kinds of living things come into existence? What is their history? Who were their parents? It is well for us that we have been born in the days when this truth and so many others are becoming known, for the more truth we know the better it is for our lives.

Let us begin by asking ourselves how we can tell whether a thing is alive or not alive. Now, that is really silly, you may say, because anyone can tell in a moment that the fly is alive and that the window-pane is not alive. We know

that the fly is alive, just as we know that a boy is alive, because he is so lively. We call anything alive that moves about itself, anything that jumps or shouts or swims or flies. We say this, but is it true?

Really it is not true. When we come to think of it, the boy is still alive even when he is asleep. He is just as alive when asleep as he was when he was playing before he went to bed. Some wise child may say this is not a good argument at all, for even when the boy is asleep he still moves, for we can see him breathing.

A BIRD'S-EYE VIEW OF THE WORLD ABOUT US

That is true. The heart has not gone to sleep; it is still moving, and it is moving because it is alive. So that, after all, the boy is lively all the time, whether he is asleep or awake, and the real question is whether a thing which does not seem to move at all is alive like the boy. Must anything really alive be really lively like the boy? We shall see.

We can imagine how a bird flying high in the air is able to look down on the surface of the earth. A bird's-eye view is a view that the bird has of the world when it is up in the sky; it sees everything at once. Now, it is always necessary to take a bird's-eye view of anything we are trying to understand. If we take nothing but short views of one thing at a time, our ideas will be as silly as a fly's idea of an elephant must be. We must see one thing at a time, and all things together—we must take both sorts of views. Let us try to take a bird's-eye view of living things.

When we do this, we see that there are two great kinds of living things, very different from each other. The difference is not in size or quantity, but in kind or quality. The one kind of living things we call animals, and the other kind plants; and they are quite different. There are many differences, but the difference we notice first when we take our bird's-eye view is a difference of liveliness. Animals move about themselves; plants do not.

THE LIFE IN THE ANIMAL AND THE LIFE IN THE PLANT

Shall we say, then, that plants are not alive? That has often been said and thought in the past, because men thought that if a thing was to be called alive it must be lively. We know that plants are not lively, like a cat; you can always find a rosebush where you left it in the garden, but the cat is not always where you left it. So men thought that because plants did not walk away they were not really alive.

And then men came to see the truth of what we have already said—that, after all, there is something about a rose which makes it more like a fly than it is like a piece of stone, even though the fly can fly and the rose cannot. So men thought there were two kinds of life; one was real, true life, like the fly's life or the tiger's or ours, and the other was a sort of half-and-half life, not the real thing but a feeble imitation of it, just enough to make a difference; and men said that that kind of half-and-half life was the life of trees and plants. The men who said these things did not understand much about them. They knew that there was something strange about the oak and the acorn, but they could not persuade themselves that anything that was not lively was really and truly alive.

But men began to find out things at last. One man learned something, the next man learned a little more, the man who came after him learned a little more still; and so the world became wiser and wiser.

THE QUIET WAY IN WHICH THE PLANT KINGDOM DOES ITS WORK

We know all that the men who lived before us knew, and we have also learned something they did not know. As men learned more about the world they were able to get a bird's-eye view; and the result of all their thinking is that we know now that plants are just as much alive as animals. In some ways plants are actually more alive than animals, even though they are not lively. The difference is that the life of the animal shows itself in liveliness, but the life of the plant shows itself in something else.

We know the animal is alive because it is lively, like the boy—like you. Your life shows itself in your liveliness. But we know the plant is alive because it helps the animal to live and to be lively, and for many other reasons.

Though the plant is very quiet and still, we know that it is alive because it makes the liveliness of the animal possible. For the animal lives on the plant, and if there were no plants all animals would die.

Animals make a great noise, but plants do just as much work, and they do it quietly. We need not always be shouting and jumping and barking or blowing a

trumpet to prove that we are alive. Plants do none of these things, but their life makes all other life possible.

We see now that life means more than liveliness. Many things that are not lively are really alive, but all living things do not make a noise and walk about. You may look at a thing and never see it move for a day, or a week, or a year, yet it may be alive. Life means much more than the idea of something which moves by itself.

Movement is not really life, because *everything moves.* Plants do not walk about the garden, but they move by themselves. When the acorn grows into an oak it moves upward. When the sunflower faces the sun as it grows, it moves not only upward but in other ways also; and if we take the leaf of a plant and look at it through magnifying-glasses, arranged so as to make what is called a microscope, we can see for ourselves that the tiny specks of green stuff which give the leaf its color are ever moving.

Everything is moving, whether we see it or not, so that life is more than liveliness. The tiny specks of stuff that make up a pebble are always moving, and so are the black specks that make the ink on this page. If liveliness means life, then all things are alive, for all things are lively if we see clearly.

This is important to understand if we are to think properly of the life of the plant. Perhaps movement is the most important thing in the world, and perhaps, if we could really see deep enough, we should find that life itself is really a very special kind of movement or liveliness. But if life is just a special kind of movement, it is so very special that it makes all the difference whether a thing has this movement or not.

The best way for us to understand what it is that really makes a thing alive is to study very simple kinds of life. The most simple kinds are plant life or vegetable life; some are lively and some are not lively, but they are all alive. If there were no plants animals could not live. Plants are older than animals; that is to say, there were plants on the earth before there were any animals.

Now, when animals got abundance of oxygen, what advantage exactly did they

Life moves in a plant as in a child. If we put an acorn in the ground it may grow into a great oak.

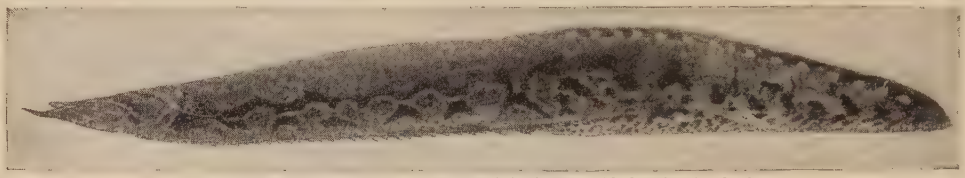
In olden days a runner would carry a flaming torch, and as he fell out of the race would hand it on to another to carry farther. So each one of us carries on life.

How can we tell whether a thing is alive or not alive? What is the difference between a living thing, like a boy or a rose, and a thing not living, like a stick?

SOME THINGS WHICH ARE ALIVE

gain? In the sea there is so little oxygen that the fish cannot use any of it for the purpose of keeping itself warm. And so the fish, like other cold-blooded animals, behaves, so far as its warmth is concerned, like a piece of stone. If you have a number of different things in a room, and leave them there, each of them will soon be just as hot as the others; if now you bring a tumbler of hot water into the room, it will get cold, and the other things in the room will get a little bit that is why other things feel cold to your hand. The truth is that air-breathing animals can help themselves to as much oxygen as they please. They simply light a fire within themselves and so keep themselves warm. The warm-blooded animal is hotter than its surroundings, because it is making quantities of heat inside itself with the help of the large supplies of oxygen it can get from the air. This does not mean that the animal just makes itself as hot as it pleases—

A catfish which drowns if kept in the water.



A fish from the Congo River which drowns if deprived of air.

The lung-fish of Central Africa which breathes the free air.

LIFE ON THE BORDER LINE BETWEEN SHORE AND WATER

warmer, though you cannot notice it. The rule is simply that the amount of heat, or warmth, in any place spreads itself about over everything, so that no one thing is hotter or colder than any other. This is the case with a cold-blooded animal, such as a fish. It is just as hot as its surroundings. If it is in cold water, it is cold; and if it swims into warm water, it becomes warm.

But now let us contrast with the fishes the case of warm-blooded animals. The fish in your hand is cold, but your hand is warm; your whole body is warm, and one day very hot, and another day not so hot. The great fact about the warm-blooded animals is that they are just as hot one day as the next, and as the day before, and that all warm-blooded animals are about equally hot. We might expect, perhaps, that a little bird would have a certain degree of hotness, or temperature, and an elephant something quite different, and a man something different again; but when we compare the hotness of all the warm-blooded animals we find that it is about the same for every one.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 255.

Photo, courtesy Metropolitan Museum of Art.

ACHILLES & THE QUEEN OF THE AMAZONS

THE Amazons were a warlike race of women who lived near the Black Sea. They never allowed any man to dwell in their country, and they even sent their own sons away and brought up only their daughters. They were strong and hardy in body, and brave and daring in soul, and they delighted in hunting and fighting. But one day when they were hunting, their Queen shot an arrow at a deer, but missed it and killed her own sister.

"I will not slay myself," said the Queen. "I will die on the sword of the bravest man in the world."

Achilles was then the bravest man in the world, and he was fighting among the Greeks and against the Trojans. So the Queen of the Amazons gathered an army and marched to help the Trojans. At first Achilles would not fight with women, but the Amazons charged the Greeks and defeated them, and he had to appear.

The Queen of the Amazons fell in love with Achilles as soon as she saw him, yet she struck him fiercely and hurt him, and he struck back and hurt her. Then when he saw how young and lovely and valiant she was, he fell in love with her. But it was too late. He had given her a blow that killed her.

PENELOPE'S MARVELOUS TAPESTRY

PENELOPE, a celebrated princess of Greece, was the wife of Ulysses, the brave warrior of whose prowess many tales are told.

One day Ulysses told Penelope that war had broken out in Troy, and that he must go and help to fight.

Penelope felt sad at being left all alone, but determined to be brave and look forward to his return. But the wars lasted many years, and Ulysses was away so long that everybody thought he must be dead. Penelope alone believed that he still lived.

At last foreign princes came to the land, and seeing how beautiful Penelope was, wanted to marry her.

But Penelope refused to believe that Ulysses was dead, and would have nothing to do with the princes, who declared that they would not go away till she promised to marry one of them. This made Penelope unhappy, but as she sat at her work one day she thought of a plan to keep the princes from troubling her.

"When this piece of tapestry is finished," she said, holding out a beautiful piece of needlework, "I will choose another husband."

All day Penelope worked at the tapestry, and at night, when she was alone, she unraveled all she had done in the day. In this way the work was never finished. The princes were amazed at her industry, but as the princess would not marry until it was done, they could only wait and leave her in peace. Then at last, after he had been away twenty years, Ulysses came home from the wars, to find his beautiful wife still waiting.

ST. GEORGE AND THE DRAGON

ST. GEORGE of Merry England was the youngest and the bravest of the seven champions of Christendom. Clad in bright armor, with his magic sword Ascalon by his side, he used to travel on his war-horse in far countries in search of adventures.

One day, as he was riding across a marsh in the land of the pagans, he saw a noble and lovely maiden walking all alone toward the seashore.

She was dressed in beautiful robes, like a bride on her wedding-day, but her face was pale and sorrowful, and she stared in terror at the sea. St. George rode quickly up to her.

On hearing the sound of his horse's hoofs the girl turned round and cried: "Flee, young knight, flee, or you will perish also!"

"God forbid that I should flee when a maiden is in peril!" said St. George.

As he spoke the sea in front of him began to rise up in great waves, and from the waves there came the sound of roaring. At the same time he heard a noise far behind him. He turned round, and saw that the walls of the city on the hills above the marsh were crowded with people, who were shrieking and wringing their hands.

"The dragon, the dragon!" cried the maiden. "Flee, or it will be upon you!"

The sound of roaring grew louder.

"Flesh and blood cannot withstand the burning flame that comes from its jaws," said the maiden. "It has destroyed two armies of soldiers; it has eaten up all our sheep and cattle, and laid waste my father's kingdom. Escape while you can, and do not try to defend me!

"Every year a young virgin comes to this marsh to be killed and eaten by the monster, in order to prevent it from rushing upon the city and slaying all the people. I am Princess Sabra, the daughter of the King, and the lot has now fallen upon me. Oh, horror, you are too late!"

While Princess Sabra was speaking the sea began to rise up in greater waves, and from the waves there came a louder and louder sound of roaring. St. George had scarcely time to clutch his spear and lift up his shield before the dragon was upon him.

It was the most terrible monster that was ever seen on earth. It was an enormous serpent, with two great wings and four strong feet, armed with cruel claws, and in its tail there was a long, poisonous sting.

It rushed through the air upon St. George, and a burning flame came from its jaws. With a sudden stroke of its wing it nearly felled him to the ground; but as it passed he gave it so fierce a thrust that his spear broke into a thousand pieces. Swinging back, the dragon again struck at him with its tail, and swept him from his horse.

He rose up reeling like a dying man, for the fire of its breath made him faint and dizzy, but his strength soon returned. Then it was he drew his magic sword, his faithful Ascalon.

In trying to strike once more the dragon exposed the tender part of its body beneath its wing, and there St. George wounded it. So deep was the wound that the dragon stood still and trembled. St. George then knelt down and prayed.

"Undo your sash and tie it about the dragon's neck. It will not harm you," he said to Princess Sabra.

The Princess did so.

"Now lead it to the market place in the city," he said.

The dragon followed the Princess as meekly as any lamb. When they reached the city, all the people fled, but St. George told them to have no fear; and with a blow of his magic sword Ascalon he killed the monster in the market place.

"This I did," he said to the pagans, "to show to you the power of God, and to bring you to a knowledge of the true faith."

When the pagans learned that it was a Christian knight who had subdued and slain the dragon, they gave up their false idols and became Christians. Princess Sabra was the first to be baptized, and it was not long before she was married to her true knight, St. George, the valiant patron saint of Merry England.

On this very same shore, so the Greek story-tellers related, the hero Perseus had slain the sea-monster that was about to devour the princess Andromeda, as she waited upon the rocks to give her life as a sacrifice to save her land. Thus do the old, old stories sometimes reappear in new dress.

ST. GEORGE AND THE PRINCESS LEADING THE DRAGON TO THE MARKET PLACE

"Tie your sash about the dragon's neck and lead it to the market place," St. George said to the Princess, and she did so. The people fled as it came along, but the dragon was as meek as a lamb.

THE STORY OF BEOWULF

LONG ago the Saxons used to sing, at their feasts, songs about a favorite hero, Beowulf, a nephew of Hygelac, king of the Geats. When they left their homes on the continent and went to Britain they did not forget these songs. From time to time, more and more tales of brave deeds were added, and after a while these incidents were woven together into one long story, like that of King Arthur. Here it is:

The old king, Hrothgar, who ruled over the Danes, built a beautiful banquet-hall where he entertained his friends. As it was adorned with horns of deer, he named it Heorot, or Hart Hall. Everyone admired it, but one night a wicked monster, Grendel, who was jealous of the feasters and merrymakers, came from his den in the marshes, and crept up to the hall where the knights lay asleep, and slew thirty of the men, dragging their bodies away to devour.

Grendel was a hideous sea-monster, half man and half beast, covered with a green horny skin. His teeth were long and sharp, like the tusks of a wild boar, and his huge body and great hairy arms had the strength of ten men. His hide was so hard that no sword could pierce it, his nails were sharper than daggers, and at his side hung a great bag, in which he could carry off those whom he was ready to devour.

Night after night, for twelve long years, the ogre visited the hall and captured the king's men. Hrothgar was very sad, until he learned that help was coming. The young Danish champion, Beowulf, had heard of the king's trouble, and was hastening from his home in the south of Sweden to help him. When he arrived with fourteen of his comrades, the king prepared a great feast, and at its close permitted Beowulf and his men to remain in the hall.

The comrades lay down in all their armor, but Beowulf took off his coat of mail wrought with shining rings of steel, unbelted his sword, and removed his helmet. For, as he said to his men, "I will strive against this fiend weaponless. With no armor—since he wears none—will I wrestle with him. I will conquer, if I win, by my hand-grip alone, and the all-wise God shall judge between us, and grant the victory to whom He will."

During the night, while the warriors were asleep, Grendel broke down the iron-barred doors, entered, and pounced upon one of the men. He seized him with his scaly hand, crunched his bones, and swallowed great pieces of his flesh. In a twinkling he devoured all, even the hands and feet. His eye shone like fire as he reached out to seize another man. Beowulf caught him and struggled with the beast. The ogre tried to free himself with a mighty jerk, but his arm was torn from the shoulder and was held in the iron grasp of Beowulf. Grendel escaped, though badly wounded. Beowulf, victorious, proudly exhibited the huge arm which he had wrenched from the monster, and hung it in the banquet hall.

Hrothgar was happy to hear the news and heaped costly treasures upon the hero, and decreed a great feast for him. After the banquet Hrothgar escorted his guests to his palace, leaving his own men to guard Heorot, for all were sure that Grendel was too badly wounded to return. But, while all were asleep, Grendel's mother, a terrible Water Witch, entered the hall, secured her son's arm, which hung as a trophy on the wall, and seized Aschere, one of the king's favorite thanes, and bore him away to the fens.

Beowulf, hearing of this ghastly deed, started out to avenge Aschere by attacking Grendel's mother in her own retreat. With his band of warriors he followed the tracks of the demon, until they reached the pool, where they found Aschere's head hanging as a trophy. Looking down into the waters, Beowulf saw the blood-stained trace of the monster, but nevertheless he bravely plunged into the water, and, guided by a bright gleam, reached the cave. As he neared the den, a strong current swept him within reach of Grendel's mother, who seized him with her horrible claws, and stabbed at him with a broad knife, but his armor protected him from her thrusts. He snatched a huge magic sword which he saw hanging on the rocks, swung it fiercely around his head, and struck so furiously that the great steel blade passed clear through the beast's neck. The monster fell headless to the ground. Then Beowulf rushed to the rear of the cave, and finding Grendel's body, cut off his head, and swam through the

tainted waters to the shore, with Grendel's head in one hand, and the giant's sword in the other.

The hero was brought in triumph to Hart Hall, where he presented the trophy to the king, and told the thrilling tale of his encounter. Hrothgar placed Grendel's head upon a spear-shaft in his great hall, and praised Beowulf for his work, and gave him many gifts. After a banquet Beowulf and his followers made preparations to go back to their own land. His task completed, Beowulf set sail and returned to his home, where he was welcomed by Hygelac in his palace by the sea. He related his adventures, and delivered messages of friendship from Hrothgar, and presented the great war-sword, the gray mail-coat and the helmet to the king. Hygelac in turn presented him with a gold-decked sword, pieces of gold, a beautiful palace, and honored him with chieftain's rank.

After a time Hygelac was slain in battle, and Heardred, his son, reigned for a while, but he, too, was killed in war and then Beowulf succeeded him as king. His fame as a warrior protected his country from invasion, and his wisdom increased its prosperity. For fifty years Beowulf reigned over his people, and all went well until the country was suddenly disturbed by the ravages of a dragon, a monstrous fire-breathing fiend, which lived in a den near the sea, gloating over a mound of treasure hidden there.

One night a hunted fugitive entered the dragon's cave, noticed the fire-drake sound asleep, and saw his immense hoard which he had guarded for hundreds of years. Greatly frightened, the fugitive seized a beautiful golden cup and carried it away. When the dragon awoke and discovered his loss he became enraged, and hurried over the land, hunting for the thief. Every night the monster appeared, lighting up the darkness with his flaming breath, burning houses, men and cattle, with the flames from his mouth.

One day the beast burned the royal castle to the ground, and set fire to many homesteads. Although old age had deprived him of some of his great strength, yet Beowulf resolved to slay the dragon and protect his people. Knowing that this might be his last encounter, he addressed his friends in farewell:

"In my youth," said the king, "I fought many battles, and yet once more will I, the aged guardian of my people, go forth to contest, and battle with the dragon. I shall win the gold by my valor, or battle shall destroy your lord."

Then, clad in heavy armor with a fire-proof shield of iron upon his arm, the old king set out for the mountain-gorge to meet the fiery dragon. With a shout he challenged the dragon to come forth. An instant later the giant rushed out, breathing flames, and attacked the warrior. As Beowulf defended himself his great sword was broken in pieces. Wiglaf, one of Beowulf's trusted followers, seeing his lord suffering in the deadly heat, sprang forward to aid him, but Beowulf drew his dagger, stabbed and slew the beast.

Poor Beowulf was so badly wounded that he felt his end was near. He spoke to his followers: "Now would I give battle-raiment to my successor. Fifty years have I ruled my people, and not one of the kings living around dared oppress me with terror or attack me with weapons. Great deeds have I done with sword and with hand-grip."

Turning to Wiglaf, he said: "Go quickly, dear Wiglaf, to view the hoard under the hoary rock. The dragon lies dead, bereft of his treasure. Be in haste that I may see the gold and look upon the bright gems. Then may I the more easily give up my life and kingship, which I have long held."

Wiglaf hastened to obey his wounded lord, and brought the treasures from the cave. The old warrior was about to die, but he raised his head to admire the gold and jewels, helmets, beakers and silver vessels. Then, taking from his neck the golden collar, he gave it to Wiglaf, together with his helmet and armor.

"Thou art the last of our race," he said. "Fate has swept away all my kinsmen at the appointed time. Now must I, too, follow them." Then he ordered his ashes to be placed in a great mound, high on a cliff, "so that the seafarers driving their tall ships over the ocean may in time call it by the name of Beowulf's mound."

The body of the monster was pushed over the cliff into the sea, a funeral pyre was built, all hung with helmets and battle-shields, and on it was placed the body of their dead leader. Afterward they built a great mound by the sea, and in it buried treasure from the cave.

THE ANT AND THE GRASSHOPPER

A NEST of ants had been busily occupied through the summer and autumn in collecting food for the winter, and they had carefully stored it in the

wonderful underground chambers of their home. Thus, when winter came, they had plenty of food to eat.

One cold day a grasshopper, who was almost starved with cold and hunger, came to the ant-hill and begged that the ants would give him a little food to save his life.

One of them asked him how he had spent his time during the summer, and whether he had not saved up anything for the winter. He replied: "Alas! gentlemen, I spent all my time in singing, playing and dancing, and never once thought about the winter."

The ant answered: "Then we have nothing to give you; for people who play all the summer must expect that they will have to starve in the winter."

Lay by for a rainy day.

THE WOLF AND THE KID

A WOLF one day saw a kid that had strolled into a distant field, and pursued it. The kid ran away as fast as it could, but finding that the wolf was

overtaking it, and that it had no chance to escape, it turned round and said: "I see that it is of no use to run away, and that I am going to be eaten. But I would like to die as pleasantly as possible, so please play me a tune, and let me have a dance before you kill me."

The wolf played a tune on the pipes, and the kid danced merrily up and down the field. The result was that the noise of the pipes attracted the dogs from the farm, who rushed up and drove the wolf away.

As he escaped into the forest he said: "This is the consequence of meddling with things that do not concern one. My business was to play the butcher, and not the piper!"

Never meddle with things that do not concern you.

THE TWO LOADED ASSES

ONE day two asses were traveling along the road. One was loaded with salt, and the other with sponges. Presently they came to a river, and as there was no bridge, they had to wade through the water.

The ass with a load of salt went first, and happened to stumble over a stone, so that he fell down in the water. He was soon on his feet again, but the water dissolved a great part of the salt and washed it away from the baskets on his back, so that the donkey found himself relieved of a great part of the load which he carried.

The ass with the load of sponges noticed this, and at once thought that he would do the same. So he lay down for a minute in the stream; but, to his astonishment, he found that, instead of the sponges being dissolved, they soaked up a quantity of water, and his load was many times heavier than it had been before. The result was that he could not get up, and the stream, which had relieved one of his burden, drowned the other.

One man's meat is another's poison.

MONA AND THE FORSAKEN MERMAN

MONA was the prettiest girl in the Scilly Isles. One day she was standing on a rock by the seashore, and the King of the Mermen saw her and fell in love with her. Catching hold of her foot, he dragged her down to his palace beneath the sea.

He was an ugly old man, and Mona did not like him, and would not wed him. His son, who was a kind and handsome young merman, also fell in love with Mona, and she fell in love with him.

This made the King very angry, and he said to the Prince: "It is time that you were married. I have chosen the fairest mermaid in my kingdom for your wife, and the wedding will take place this afternoon. Make haste and dress yourself for your bridal."

Then, taking Mona to the kitchen, he said: "You will have to prepare the wedding feast. If all the pies and tarts and puddings are not ready in an hour, I shall cut off your head."

There were only rows of empty pots in the kitchen and Mona could not find anything to cook.

But when the wedding party entered the church the young Prince spoke.

"I have forgotten the ring," he said. "I must run back and get it."

On reaching the palace he rushed to the kitchen and found Mona in tears.

"Let me help you," he said. "This is how mermen prepare dinners."

He touched the pots with a magic wand and filled them with meats and puddings, so that when the wedding party came back to the palace Mona had an admirable feast ready for them. When the King of the Mermen saw it, he was enraged.

"Someone has been helping you," he said. "I will look into this."

At midnight the Prince and his bride retired to their room.

"Stand by their door and hold this lighted candle," said the King to Mona. "When it has burned halfway through I shall cut off your head."

When the candle was burned nearly halfway the Prince asked his bride to hold it while Mona lighted the fire.

"Is the candle burned halfway through?" said the old King.

"Yes," said the bride.

And with one sweep of his sword he cut off her head. The next morning the Prince asked his father if he might marry.

"You were married yesterday," said the old King.

"But you have cut off my wife's head," said his son.

When the old King understood what had happened he saw that he could not prevent his son from marrying Mona. So they were married, and for some years they lived together very happily, and Mona had two charming little baby mermaidens.

One day Mona asked if she might go up to earth once more and visit her mother and father.

"Very well," said the merman. "I will build an enchanted bridge of crystal stretching from our palace to the Scilly Isles. You must be careful not to let any man kiss you, and I will wait for you by the seashore at sunset and bring you back safely beneath the waves."

Everybody in the island had thought that Mona was drowned. Her father was filled with joy to see her again, and he ran up and kissed her very tenderly. But as soon as her lips touched his she forgot all about her husband and her little mermaidens and her palace under the sea.

She was not able to remember where she had been. Yet she would sit for hours by the shore and gaze sadly at the waves, and try to think of something that had happened there. Sometimes as she lay awake in her father's cottage she seemed to hear voices calling.

"What a strange noise the wind is making to-night!" she used to say.

But one summer night, when her window was wide open, someone came beneath it and called her.

"Ah, Mona, Mona!" he said. "You promised to return at sunset and you keep me waiting still. Mona, have you forgotten the merman who loved you? Your little baby mermaidens cry for you, Mona, and you do not come."

As Mona listened it all came back to her mind. She jumped out of bed and opened the cottage door. The merman was standing there, and she returned with him to her palace under the sea and was never seen again on the earth.

THE NEXT STORIES ARE ON PAGE 145.

MONA AND THE MERMAN PRINCE IN THE PALACE AT THE BOTTOM OF THE SEA

Standing by the seashore, Mona was seized by the King of the Mermen and carried to his palace at the bottom of the sea. The King's son, a kind and handsome young merman, fell in love with Mona.

WHAT THIS STORY TELLS US

WHO shall count the treasures of the world that men have made—the lovely things that have come down to us through the ages? Nature has filled the earth with beauty, and in the dark hours of the world it is good to remember that spring and summer have never failed to come, that the violet and the daffodil have never failed to bloom, that June will bring red roses and lift up the hearts of men. And man, too, has made a glory in the world not unworthy to compare with nature in her glory. It is good to think of all the heritage of art that comes to every child alive, of the gems that pack our museums, the glory that enriches our great galleries, the old cathedrals that stand to witness man's faith in his Creator—a faith that has never been lost. Here we shall read of the most beautiful things that men have made—pictures and statues and buildings from all ages and all lands.

THE RICH TREASURE THAT IS OURS

THE art of the world is a glorious inheritance of which we can never be too proud, and it is our very own

Michelangelo.

The great pictures of a nation may hang on the walls of public galleries, but every time we go and look at them it is as if we stamped them with our own names. They thus become our private collection—a treasure-house of lovely things that time cannot wither nor custom make stale. And, by a beautiful magic, the more miserly we are, the more we gloat upon our treasures and count them over, the richer we become.

The world showers these gifts upon us. It is not only in our galleries and museums, in great paintings and sculptures, that we find things to gladden our eyes. Art is with us everywhere. We can scarcely walk by a bookseller's shop or a pottery store or a jeweler's window without being face to face with something we owe to the art of the past. It may be a picture painted and reproduced yesterday, an enamel or china bowl fresh from the maker's hands, but its beginnings lie in the remote civilizations of the world. It may be a beautiful doorway or a pedestal of modern construction, but a stone was first used this way thousands of years before Jesus was born. The art of to-day is the inherited sense in large or small degree of the art of all time.

So that our treasure, our inheritance, is twofold. For centuries upon centuries the nations of the earth have been creating and storing up lovely shapes and colors that are our joy to-day. These are a historic possession. And every year that passes, beautiful things are made which owe their origin consciously or unconsciously to this historic possession; and in these we are again enriched. In art, more than in any other province of the world's history, we are indeed the heirs of all the ages.

Surrounded as we are by innumerable expressions of art, we are apt sometimes to confuse an inspired picture with its imitations, and to take for great what is clever but inferior. We need some standard by which to set our judgment, and we find sooner or later that the Old Masters are the best of all teachers.

A picture or a statue is not necessarily good because it is old. A great deal of ancient art is treasured mainly because it is a living emblem of a dead

civilization, and illustrates for us the story of a race that is gone. But there are certain paintings and sculptures which can be taken as great art, the work of the loftiest genius the world has known, and they hold their proud place, not merely because of their age, but because generations of men have judged them great.

THE THREE CHIEF CLASSES OF THE GREAT ART OF THE WORLD

In the minds of some people there is at first an unwillingness to take the opinion of another, even of generations of men. And often, if some of us were courageous and sincere, we should confess that we preferred some of our familiar little everyday pictures to the paintings of a Titian or a Botticelli. This is, perhaps, because we have never had an opportunity of studying art seriously enough. It takes two to make a picture, one to paint it and the other to look at it. A great picture is the subject the artist painted plus the secret he painted into it. Until we understand something of that secret we cannot fully appreciate our magnificent inheritance.

The great art of the world—the art which has passed the ordeal of centuries of criticism—falls into three chief classes: painting, sculpture and architecture. Architecture, indeed, may be called the parent of all art, because for a long time pictures were made only to decorate spaces on walls, and they were painted on the fabric of the building itself; the framed picture is a comparatively modern adaptation of the colored wall-panel. And statues were chiseled to adorn niches in temples and palaces, or figures cut in low relief to make a long frieze pattern.

THE FEELINGS THAT INSPIRED THE WORLD'S GREAT PICTURES

Whatever it may be, sculpture, painting or architecture, this work of the Old Masters has a kind of family resemblance, in that it owes its birth to an instinct common to its kindred. In almost every case it was inspired by one of the great emotions of the human heart—love, sorrow, reverence or worship—and without some such feeling no great art is ever conceived.

Love has inspired more pictures than any other human emotion, but love bears a very wide interpretation. There is physical love—the love of husband, wife or child; love of the mind—the love of abstract qualities, such as truth, courage; spiritual love—the love of God and of the earth, which poets call the garment of God. The pictures inspired by sorrow are fewer, but stir our feelings intensely, because every one of us has had some experience of sadness, some touch of tragedy.

Love, sorrow, worship—in a way the greatest of these is worship, which holds in itself all three. Worship painted pictures, carved statues, built temples and cathedrals, and made them greater than man because they held a sense of Godhead, of eternity inclosing time as the universe incloses the earth.

If we think seriously of any picture the world calls great, we shall see that its theme is one of these powerful emotions; and any work so conceived, even if poorly executed, has in it the seeds of greatness because it strikes at the heart of the human race. This basic feeling, however, is, so to speak, the foundation, the framework and not the finished edifice. It is the subject the artist painted minus the secret he painted into it, which some of us spend our lives trying to discover. The secret was his own imagination and sense of beauty, and therein lay his final and unapproachable greatness.

THE FEELINGS OF THE SOUL THAT ARE PERFECTLY REAL

We ask what is beauty, what is imagination, and no one can find an answer. We know where beauty and imagination are revealed, in form and color, which satisfy the soul as food satisfies the body; but their nature is hidden deep in the mystery of life. We can think of them as senses of the spirit, as real as are the physical senses of sight, hearing, touch, taste and smell. Just as our ears record the sound of a piece of music, and our eyes register an impression of the shape of a piece of stone, so these spirit-senses "feel" the vision of perfect sound that makes the music beautiful, the vision of perfect contour that makes the stone a lovely statue.

Beauty and imagination reach out beyond the actual to the ideal. For instance, thousands of artists have drawn portraits of old women. Rembrandt drew the portrait of an old woman, and it is one of the greatest things in the world. Why? Because, while through his sense of sight he recorded the features, by his sense of beauty and imagination he re-

corded something infinitely wonderful: not the face of one old woman, but the lovableness, the dignity, sorrow and other-worldliness of old age of all time.

Hundreds of men have painted landscapes and put on to their canvases the glow of the sun and the radiance of the sea. Turner painted that same glowing sun, that same radiant sea, but his sense of beauty, his imagination, reached out to an intangible, heavenly glory, and so he put into his pictures "the light that never was, on land or sea, the consecration, and the poet's dream."

THE PARTHENON, SHAKESPEARE'S PLAYS AND A GREAT SONATA

These spirit-senses of beauty and imagination are powers which the human soul has developed through thousands of years of effort to express itself. All art, poetry and music are forms of self-expression. Next to bodily needs, such as food, shelter, clothing, the need of self-expression is one of the most powerful of human instincts.

Only a few in each generation are born without it. Almost every man is moved by it to the doing of certain kinds of work on which he can stamp his own individuality. It is that which makes a child set up an erection of sand with patience and care, and then say, "*I* have made a house." It is that which built the Parthenon and wrote The Winter's Tale and composed the "Pathetic" sonata. We are told by Indian mystics that it was because of God's desire to express Himself that He created the world—flung from Him a whirling atom. Upon that atom, grown huge and populous, we live and are trying to express the beautiful, which, in the end, is God.

THE GREAT HUNGER OF MEN FOR EXPRESSING THEMSELVES

Art is the very earliest form of this self-expression. Before men could read or write, while yet their clothing was the skins of animals, they could draw. They rendered the objects about them in the simple way a little child would draw its pet kitten on a slate to-day. They drew in their idle moments, when the chase was over and the food had been broiled and eaten by the cave fire. Between those early efforts and the art which to-day is so high a calling there is a great gulf fixed. Thousands of years are needed to span the gulf, and during that time, while whole civilizations rose to power and died, the craving to express himself in beautiful imagery became a spiritual hunger in man's heart.

To look back on the art of the world is, in a way, to see the story of the growing pains of this æsthetic life which is now our pride and our great joy. The early art of the world was centred round the several religions of the human race, and for a long time the sense of beauty was small and stunted, held back by false ideals. Imagination went astray, and the gods men portrayed in their sculpture as high above humans, were often only decorated puppets.

But while his soul was thus struggling in the half-light, man was finding more power in self-expression. In each passing century art was more noble than before, lost more of the things that do not count, and grew to be a very real part of the life of a nation. Soon it came to pass that men were born whose imagination and sense of beauty were of such power as to override all other instincts. These were the men we call geniuses, in whom the inward feeling for self-expression in lovely imagery became a driving force that pushed a wedge, so to speak, through the history of their day.

NATIONS THAT FEEL DEEPLY, AND NATIONS BLIND AND DEAF

To these gifted ones art mattered more than food or clothing; they spent their lives working out their ideals of purity in line and color. These were their secrets, their inner dreams, to which they gave form in their painting and sculpture. But nations, like men, are different one from another; some races have been sensitive to beautiful impressions, and others have been blind and deaf. The spirit of beauty and imagination filled one people—the Greeks—as if they were one man. The soul of Greece was loveliness. There has never been another nation to whom art was so truly a part of life.

Even in Greece there were generations that fell short of the best. A sense of pure beauty comes to a race only in its flowering time; when the soul of a people withers and droops, the art it expresses becomes unlovely and false. Nature is not generous in granting perfection. It is, perhaps, because artists have always dreamed of realizing perfect beauty that genius is called the sorrowful gift, always urging the soul to express the inexpressible, to attain the unattainable.

But it is not only artists who yearn for the vision beautiful. Almost every man, woman and child has inherited, in some degree, the instinct which is the beginning of art. And therein, as soon as we realize it, lies a wonderful happiness. It is because we have in our own souls—we who have never painted a picture or carved a statue—a latent sense of beauty and imagination that we are moved by great art. For this reason, we stand spellbound before a picture and go away haunted by its lines and colors. It is not necessary for us to understand the subject of the picture. We see something beautiful and it calls to something beautiful in us.

WE ARE ALL DESCENDED FROM THE GENIUSES OF THE WORLD

We are all, in a way, descended from the geniuses of the world, and the longer we live, the more we cultivate our sense of beauty, the more shall we show the marks of our breeding. There is scarcely a child born into the world who does not carry in himself the seeds of greatness. And the reason the greatness so rarely flowers is due to the accident of circumstance, upbringing, surroundings. So that we are in the state of knowing in our inmost souls what beautiful sound is, and being unable to express it in music; of realizing dimly what color is, and of being helpless when someone offers us a palette and a canvas.

Art says for us the things we cannot say for ourselves. As our feeling for beauty grows we realize that artists speak for us in other ways than simply presenting shape and color. Art gives speech to the dumb emotions of the soul.

Great happiness or great sorrow seals our lips and keeps us dumb; but as we look on great pictures and sculptures we find that happiness or that sorrow portrayed forever by someone who had the power to speak it out.

ART RUNS THROUGH THE WHOLE WORLD OF THOUGHT AND FEELING

And in little ways as well as greater ones, we owe to lovely things the expression of ourselves. There is not any part of thought or feeling that art does not reveal. It is as if beauty and imagination, like pagan goddesses, immeasurable in their power, had thrown over the world a fine-meshed net, and caught all the outward-flying fragments of human wishes and hopes and held them forever in a golden web. And so we come to see that great statues and pictures are more than lovely shapes and colors: they are beautiful dreams come true, heavenly visions crystallized in stone. They are the sum of all that is best in the mind and heart and soul of the human race. They are a fragment of bygone time and yet a piece of to-day and to-morrow. They are the great fulfillment of all the longings of each man's soul, the ideals and hopes that flit to and fro in the mind, the loveliness we yearn to possess. Once and for all, the senses of beauty and imagination have seized the fleeting raptures of daily life—the dawns that are full of little angels' wings, the sunsets that are full of spring flowers, the hours when earth is very near to heaven.

And we may be quite sure that a picture which does not stir our own imagination, which does not make us conscious of other qualities than color and shape—of the artist's secret, in fact—is not great. It may be a pleasant and attractive subject, but if it ends in itself it will die. It is the secret of art forever to tantalize us with its secret.

THE THRILL OF THE FIRST MAN WHO DREW A BEAUTIFUL THING

Art, we know, has been present as a living force in the world for some sixteen thousand years, but it is still as mysterious a presence as it was to the first man that drew a beautiful thing and thrilled with the thought, "*I* have done that." Art has become, in a way, a great science. It has hundreds of handbooks. And yet it is a fairy tale. Whoever makes it his career must study long and hard; yet he can do nothing without his elusive dreams. For when painters have spent rich years in learning and toil, and have grown great, they are still what the unlearned artists of old were: magicians who make the world a garden.

The work of these inspired ones of yesterday and to-day lies scattered about the world like flowers which bloom forever. We cannot think how bare our lives would be lacking these blossoms. Color, shape and line—finely drawn faces, lovely forms, green fields and tossing seas—are brought within the range of our stay-at-home eyes by means of great art. We should never count an hour wasted that is spent in looking at these treasures, for every time our hearts are moved by beauty, our souls are marching on.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 189.

THE EVERLASTING GLORY OF ART

Art, the expression of the love of beauty in the soul of man, is the glory of the world throughout all ages. Here we give a few examples of the treasures men have created for all mankind to love. They show art in various fields, as: painting, sculpture, mosaic and metal work.

THE VIGOROUS HEAD OF MICHELANGELO'S GIGANTIC STATUE OF DAVID, IN THE ACADEMY IN FLORENCE

A SILVER MEDAL OF THE SEVENTEENTH CENTURY

BRONZE HEAD FROM HERCULANEUM

A MAJOLICA PLATE FROM ITALY

A SIXTH-CENTURY IVORY FROM FLORENCE

A FOURTEENTH CENTURY CAVALRYMAN

THE COFFIN OF AN OLD EGYPTIAN

AN IVORY PANEL A THOUSAND YEARS OLD

A WROUGHT-IRON WINDOW IN THE CHURCH OF SANTA CROCE, FLORENCE

A RARE LANTERN FROM SIENA

A GOLD MEDAL OF CROMWELL'S MINISTER, JOHN THURLOE

A TURKISH JUG OF THE SIXTEENTH CENTURY

A MEDAL FROM SYRACUSE 25 CENTURIES OLD

A COLUMN IN A PALACE OF FLORENCE

A MINIATURE OF CROMWELL, BY CHRISTIAN RICHTER

A PERSIAN DOOR IN LACQUER WORK

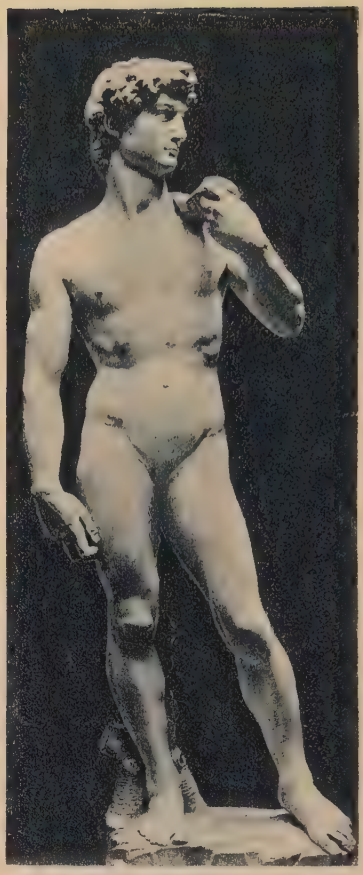
INCENSE-HOLDER FROM THE PITTI PALACE, FLORENCE

AN OLD GERMAN CUP IN THE FORM OF A COCK

A DECORATED WATER-JUG FROM GREECE

MISS LINLEY & HER BROTHER, BY THOMAS GAINSBOROUGH

MARCUS AURELIUS



MICHELANGELO'S DAVID

A DOGE OF VENICE, BY GIOVANNI BELLINI

AN OLD LADY, BY REMBRANDT

MISS BOWLES, BY SIR JOSHUA REYNOLDS

MISS HAVERFIELD, BY THOMAS GAINSBOROUGH

A FINE PAINTING OF A WOMAN AND A CHILD, BY FRANS HALS, THE DUTCH ARTIST

AN ETRUSCAN VESSEL IN BRONZE

AN ANCIENT BRAZIER FROM ITALY

FOOD-CARRIERS OF OLD EGYPT

A WOODEN BUST OF THE SIXTEENTH CENTURY

A FOURTH-CENTURY MOSAIC FROM RAVENNA

COPPER MODEL OF A SHIP

A BIT OF PAVEMENT FROM FLORENCE 600 YEARS OLD

A CHESSBOARD IN IVORY 400 YEARS OLD, FROM THE BARGELLO MUSEUM, FLORENCE

FERDINAND OF AUSTRIA, BY VELASQUEZ

MICHELANGELO'S STATUE OF VICTORY IN FLORENCE

A CHINESE GODDESS IN WHITE PORCELAIN

FORTUNA—A SIXTEENTH-CENTURY STATUE

AUGUSTUS CÆSAR IN FULL ARMOR

THE ANGELUS, BY JEAN FRANCOIS MILLET

A STATUETTE OF NAPOLEON, BY GEROME

SALISBURY CATHEDRAL

PISA BAPTISTERY

NOTRE DAME, PARIS

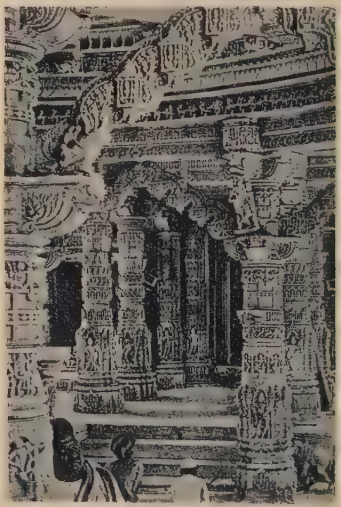
ST. GEORGE'S CHAPEL, WINDSOR

A TOWER BUILT BY JULIUS CÆSAR IN PROVENCE

ROMAN ARCH AT ORANGE

A BEAUTIFUL OLD GATEWAY IN CONSTANTINOPLE

A 500-YEAR-OLD GATEWAY AT NORWICH



THE CARVED INTERIOR OF AN INDIAN TEMPLE

WHAT THESE PAGES TELL US

FOREVER in this life we are asking questions; forever, throughout this world, wise men and children are saying "I wonder why?" Where do we come from? Where are we going? What happens when we are asleep? What brings a mighty forest from a few small seeds? Has the sea been moving for ever and ever? Who holds the stars up and lights them at night? Who puts the thoughts in our heads and the feelings in our hearts? How does a bird find its way from South America back to the same little nest it had. To all of us come questions, and never will they stop while the world goes on, because out of the answer to one question another question grows. So it must be, for the wonder of the world has no end; the longer we live the more we wonder about life. Here are hundreds of questions already asked by the readers of this book.

WHY DO I LAUGH AND CRY?

YOU laugh and you cry because you are "made that way." It depends upon the way in which your brain and your body are built. What we call the lower animals do not laugh because their bodies and brains are different. After all, you laugh when you are tickled, even though you may not be pleased. That is really easier to explain. It is the response the nerves make to what we call a stimulus. If a bright light strikes your eye, you quickly shut down the eyelid because your brain is so made.

That is a simple way of replying, and laughing when you are tickled is really the same, only that, instead of doing only one thing, you do a number of things all at once. You move many muscles of your face instead of merely moving the muscles of your eyelids. You also move the muscles you breathe with in an unusual way, and the muscles you make sounds with. It is this particular movement of all these muscles together that we call laughter, and it is really a reply to the tickling, just as drawing away your foot is a reply when someone tickles the sole of it.

It is the same with crying as with laughing. We do not know why our brains should be so made, for, though there is much use in tears when we are not crying, there is no use in crying when we are hurt.

When people grow older they find that crying does not do much good, and so grown people usually do not cry when they are hurt. The higher part of the brain is the master of the lower part and can order it to do things or forbid it to do things. Generally the lower part of the brain obeys the orders of the upper, though not always. Now, it is the lower part of the brain that replies by crying when we are hurt, so that even the tiniest baby can cry. But when we grow older we usually gain in what we call self-control. We tell the lower part of the brain that it must not do as it feels inclined to do. So we stop crying.

There is no known reason why tears should come when we cry, but there is a very good and beautiful reason for the tears we are really making all the time we are awake, though we know nothing about it. You know that every few seconds you wink both your eyelids at once. If you did not, your eye would soon cease to work.

Now let us see what winking does for the eye. When the eye is open, the front of it is exposed to dust and dirt, and also the front of it is apt to get dry, and if it got dry we could not see properly. Yet, how is it that, though we never wash the front of our eyes, they are always clean? *It is because we wash them every time we wink.* Up above each eye, rather to the outer

side, is a tiny thing called the tear-gland, and all the time we are awake this is slowly making tears. Then when the front of the eye feels itself becoming rather dry, and perhaps a little dusty, it tells the brain, and down comes the eyelid with a tear inside it, so washing clean the front of the eye.

If you look at the inner corner of your lower eyelid you will see a tiny little hole. The tear runs down this and finds itself —where do you think? When you have been crying a great deal, do you not have to blow your nose? The reason is that tears run down into the nose. All the time we are awake this goes on, keeping our eyes moist and clean; but when we cry we make far more tears than we need, and so they get spilled over the edge of the lower eyelid, and run down our cheeks.

But though the tears, when we are not crying, are so useful that we could not do without them, yet it is no use to make too many of them. Let us not shed too many tears in this beautiful world.

WHAT DOES ENCYCLOPEDIA MEAN?

This is quite an easy question, even though the name of this book is longer than any word in it. *En* means *in,* and is added to make the word stronger; indeed, the word is often used without the *en,* and just written *cyclopedia.* Then the next part of the word comes from the Greek word *cyclos,* a circle, and tells us that the book is not about one thing only, but goes all the way round knowledge. And the last part of the word is just the English form of the Greek word *paideia,* which means teaching or instruction. So this book is a circle of teaching.

But the name is better even than it looks, and perhaps ours is the only kind of book that ought to have this name; for the word that means teaching comes in Greek from another word, *pais,* which means a child, because, of course, teaching suggests child, and a child suggests teaching. So the very word tells us that it has something to do with a child.

COULD WE WALK WITHOUT OUR TOES?

There is no doubt that we could walk without toes, but we should not walk nearly so well, nor so gracefully, nor so safely, for the simple reason that our toes spread out over the ground to a certain extent, and so give us a greater space upon which to balance our bodies. In these civilized times, when everybody wears shoes, the toes themselves are really very little used, but in the early days of the human race they were very valuable, and capable of much more movement than now. A person without toes could easily walk, but his steps would be somewhat uncertain, and his movement more restricted.

WHAT ARE RHODES SCHOLARS?

Cecil Rhodes was an Englishman who went out to South Africa when only a boy and soon began to dig for diamonds. He was successful, and when twenty years old returned to England and entered Oxford University. His health was delicate, and it was eight years before he took his degree. During these years he spent much time in South Africa seeking health and looking after his business affairs.

After leaving Oxford he returned to South Africa and became very wealthy from mines of gold and diamonds. The story of his power and influence is very long, but we cannot stop to tell it here. When he died, in 1902, it was found that he had left most of his wealth to trustees to found scholarships at Oxford University. Each scholar was to be appointed for three years, and to receive a sum sufficient to pay all his expenses.

Mr. Rhodes believed that the world would be helped if all English-speaking people knew more about one another. Therefore the scholars were to be appointed from Canada, Australia, New Zealand, South Africa and other parts of the British Empire, and from the United States. The German emperor was also allowed to appoint five scholars a year. Each province in Canada was to appoint a scholar every year, and each state in the United States was to appoint a man two years out of every three. There are about 175 of these Rhodes scholars in all.

WHERE DOES THE TADPOLE'S TAIL GO?

At a certain stage in the life-history of a tadpole some of the cells within the tadpole's body begin to attack and devour the cells that make up the tail. The tail is gradually eaten away and absorbed, until finally, by the action of these cells, there is nothing of it left. The material thus disappears by the process which is known as absorption; that is to say, it is used up by something else.

WHAT MAKES THE SEA TASTE OF SALT?

The sun sucks up the water from the sea, but it sucks up nothing else. The salt of the sea has been brought to it by the rivers. These, as they come down from the land, melt away from the land anything that water can melt, and this they carry into the sea. River water is salt, too, only so very little salt that we notice nothing. Sea water is so much salter chiefly because it contains all the salt that the rivers have been carrying down to it for ages past. One of the commonest kinds of salt in sea water is ordinary salt that we use at table, but there are a great number of other kinds too. We must remember that, though table salt is the only kind of salt we usually think of, yet "salt" is really only a general word for a large number of compounds, like one another to some extent, yet different. It is a mixture of a great number of these that helps to make the sea salt.

HOW MANY ENGLISH WORDS DO WE USE?

We need not tremble at the number of words it is possible to use. Our greatest writers find quite a small number sufficient for their purpose.

Shakespeare, with all his varied writings, used only about 15,000 different words. Milton needed only 8,000 different words for Paradise Lost, while the Old Testament contains fewer than 6,000 different words. Some country people use only about a thousand different words, and most of us use no more than two or three thousand.

The beauty of writing and speech lies, not in the number of words used, but in the choice and placing of them. Simple language is the most beautiful. The finest English writing is in the Bible, in Robinson Crusoe and in The Pilgrim's Progress, and in each of these books the language is so simple that a child may understand, while great scholars find delight in it.

WHAT IS IT THAT MAKES A NETTLE STING?

The leaves of a stinging-nettle are covered with small hairs with sharp, hooked points that will break off when they are lightly touched. But the nettle does not merely prick: it *stings*. This is because the hairs are filled with an acid which gets under our skin, through the hole made by the point of the hair. This makes our skin uncomfortable. *Formis* is Latin for "ant," and this acid is called formic acid because it is found in the bodies of ants. There it probably prevents other animals from eating the ants, because it is not nice to taste. This is one of the thousands of ways in which animals and plants are protected from their enemies—like the poisoned tooth of the serpent, the inky stuff made by an animal that lives in the sea, so as to blind its enemies, the unpleasant and often poisonous oils found in the leaves of certain plants like the tobacco plant.

HOW DOES THE SPEEDOMETER OF A MOTOR CAR WORK?

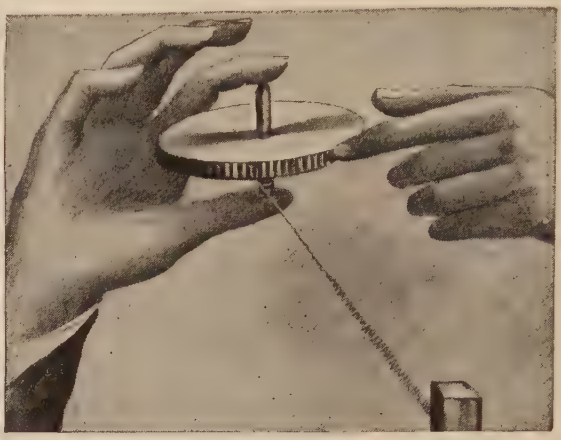
We can get an idea of how a speedometer works if we imagine that we hold in our hand a small wheel with a spindle through it, and a fine coil spring attached to the spindle. If we keep tapping the edge of the wheel, it will go round and gradually wind the spring up, but as soon as we stop tapping, the pull of the string will send the wheel back to its original position. If a hand were fitted to the spindle so as to move over a properly numbered disk, a measure of speed would be obtained. Thinking of this, we can look at two popular types of the speedometer, the rotary and the dial types.

From the front wheel or driving shaft of a motor car a flexible tube runs to the dial box. When the car is moving, either the front wheel rotates a cog-wheel or the shaft rotates a pulley which revolves a fine chain of many links concealed in the flexible tube. At the top of the chain is a circular magnet, and this therefore revolves. Fitting over the magnet, but not touching it, is (in the rotary type) an inverted drum on which are printed figures to show the car's speed. The rotating magnet acts with magnetic force on the drum, and this magnetic influence has the same effect as the finger tapping on the wheel: it causes the drum to revolve. The faster the magnet revolves—that is, the faster the car is going—the greater the magnetic pull on the drum, and a number is brought to the opening showing the speed of the car.

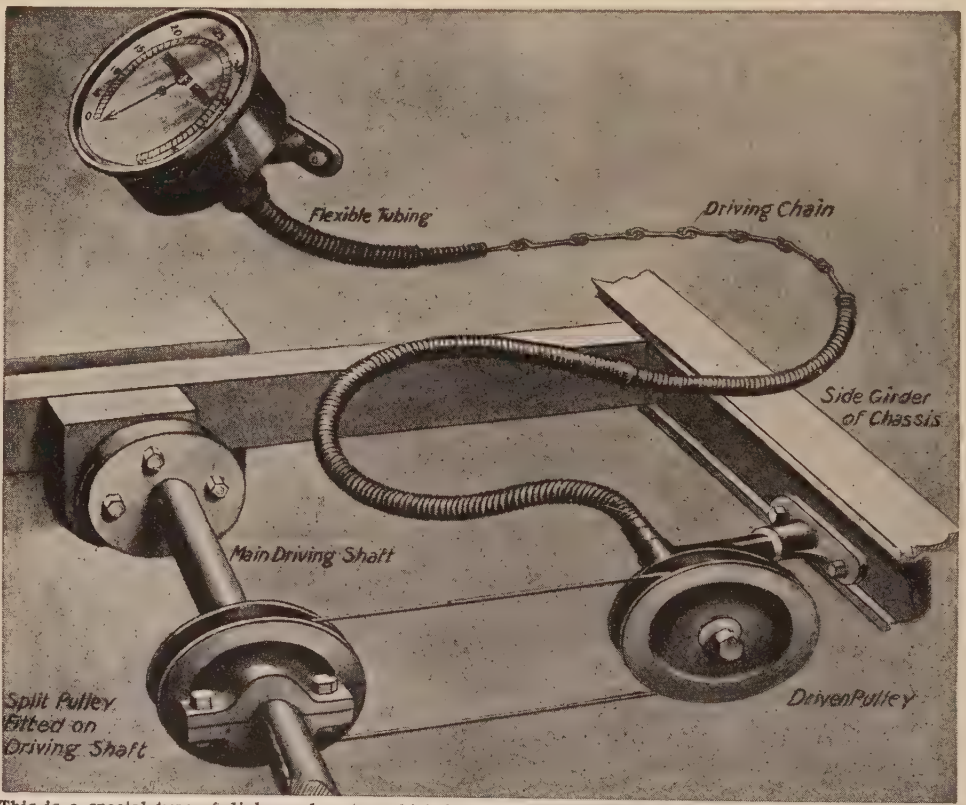
In the dial type the magnet fits into the centre of the indicator body, but is not in contact with it. As the magnet revolves, a current moves a pointer round a fixed dial. Movement of the drum or pointer is restrained by the counter-tension of a coiled spring. As the magnetic attraction increases with the speed, the resistance of

HOW MAGNETISM MARKS THE MILES

Here we see one type of speedometer. The top figures on the left show the total mileage run. Those on the right show the day's run. The end figure indicates a fraction of a mile. Below is the edge of a revolving drum showing speeds up to 60 miles an hour. The figure which is opposite the fixed pointer shows the speed per hour.

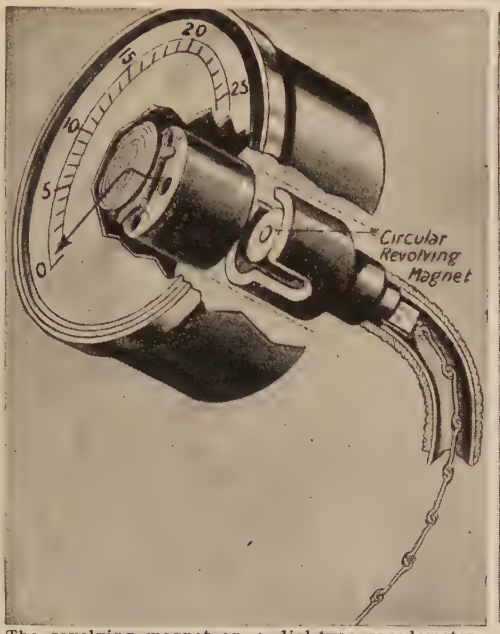


The principle of the speedometer is a magnetic force acting on a drum or pointer so as to overcome the tension of a spring. This force can be likened to a finger trying to push round a wheel attached to a spring. When the finger is removed the force diminishes, and the spring pulls the wheel back to the position where it was at first.

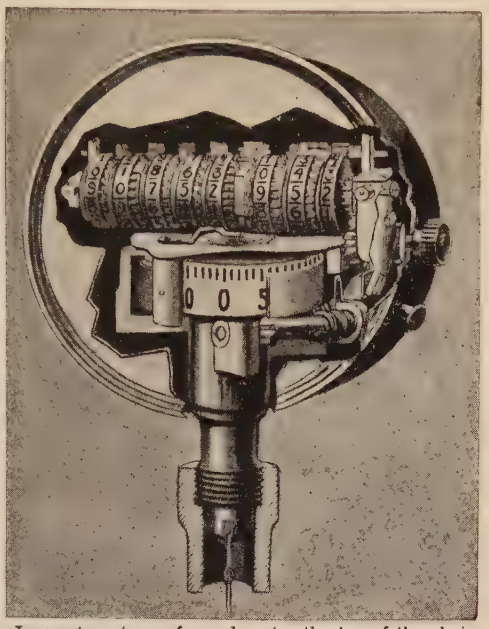


This is a special type of dial speedometer which is worked by pulleys from the driving shaft of the car. Inside the flexible tube, which has a spring lining, is a fine driving chain, which is attached at the top to a circular revolving magnet. When the car is in motion the flexible chain in the tube rotates the magnet at the top, and this creates a magnetic force which increases with the speed and acts on the pointer.

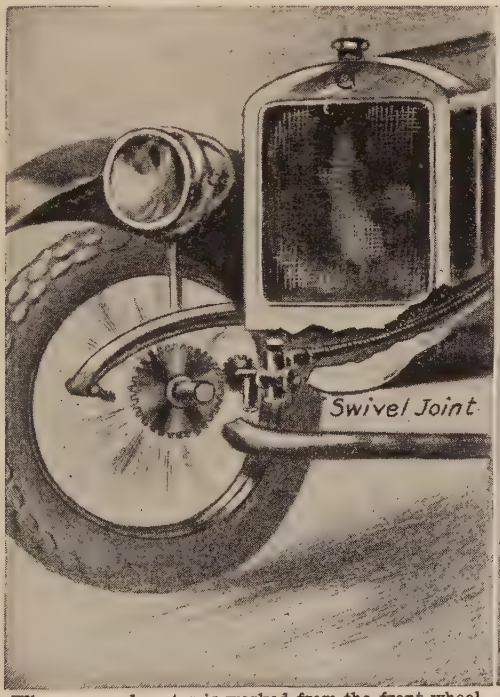
A LOOK INSIDE THE SPEEDOMETER



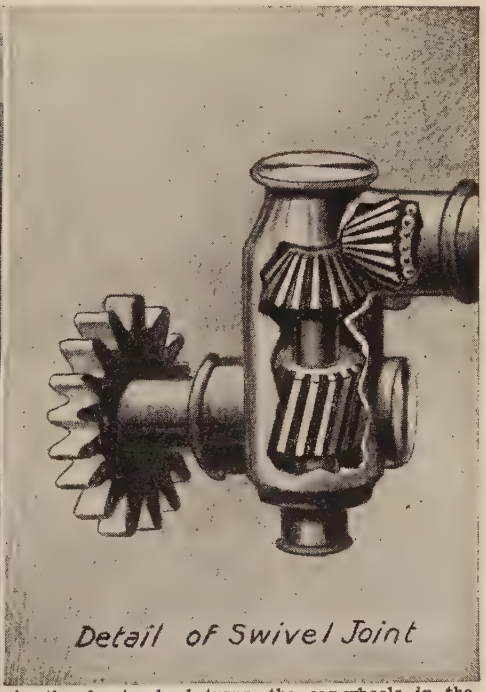
The revolving magnet on a dial-type speedometer transmits a current which compels the pointer to revolve against the coiled spring holding it. As the car slows down, the spring overcomes the dying force of the magnet and the pointer goes back to its first position at zero.



In a rotary type of speedometer the top of the chain leads to the magnet in the revolving drum, on which are the figures. The magnetic force makes the drum revolve. Total mileage up to 99,999 and trips up to 99.9 miles are recorded by means of gear wheels shown at the side.



When a speedometer is worked from the front wheel of a car, a cog-wheel on the hub actuates cog-wheels in a swivel joint, and these cause the chain in the tube to rotate.



As the front wheel turns, the cog-wheels in the swivel joint are brought into motion. The top cog-wheel is attached to the chain in the tube, and it therefore revolves.

the spring is gradually overcome, and the hand or drum moves round. As the car slows and stops, the magnetic force declines too, and the hand or drum goes back to zero. The same driving power carried up the flexible tube actuates gear which turns the mileage recorder. One type registers up to 10,000 miles, but the extreme right-hand figure indicates a fraction of a mile. When the right-hand figure has recorded 9, and 0 is appearing, the disk on which the 0 is engages the disk immediately to the left which thus advances one figure higher, and so on right across. When 9999.9 miles are recorded and the final mile is just completed, the recorder shows zero in all places, and then starts to record the fractions of the first mile of a new 10,000 miles.

WHAT MAKES ME WAKE UP IN THE MORNING?

In order to understand this we must realize that we do not sleep in just the same way all through the night. To begin with, we sleep deeply. Now, it is good to sleep deeply. It makes us look well and beautiful, and people seem to have noticed this, for they call the first hours of sleep the "beauty sleep."

But for some hours after this we sleep less and less deeply. We can easily find this out by noticing exactly how loud a noise is required to wake one up at various times in his sleep. And we find that when he has had nearly enough sleep he will be wakened by a noise which, a few hours before, he would not have noticed.

That is the sort of thing that happens when we wake. We have been sleeping less and less deeply for some time, and our brain has almost awakened of itself. Then there comes a sound or a light, or perhaps we move in bed and feel ourselves moving, and since we are already very nearly awake, the sound or the light or the feeling wakes us up. Of course we live in a way that we have made for ourselves; but if we lived out of doors, as men did long ago, and as birds do still, light would wake us up. That is what wakes the birds now.

WHY DOES A TREE GROW UPWARD?

The first thing to say in answering this question is that the whole tree does not grow up. Part of the tree grows downward, and that is the root. Each grows to the place where it can do the work for which it was made. In the seed from which the tree grows there are certain cells which are meant to form the part of the tree that is to live in the air and the light. Wherever the light is, they grow toward it. On the other hand, there are other cells which grow best in the dark, and which even seem to be affected by the gravitation of the earth, so that they grow best toward the centre of the earth.

It is possible to play tricks with the seed, as, for instance, to turn it upside down; but the rule is that the plant will do its best by curling round as it grows to insure that the *shoots* shall get into the air and the light, and the *roots* shall grow downward. So the tree—and this is true of nearly all plants—has two parts: one that lives in the air, and one that lives in the soil. Neither part could live without the other, and the tree is so made from the first that the right part of it, that which is capable of making leaves, must grow upward into the light and air; while that part of it which can suck up water and salts, and also can hold firm must grow downward into the earth.

WHY IS IT DARK AT NIGHT?

If you take a ball and hold it near a bright light, said the Wise Man, the half of the ball next to the light is shone upon, and the half of the ball away from the light is dark. If you mark a spot on the ball, and then turn the ball round and round like a top, that spot will be shone upon half the time and will be in the dark the other half of the time. We live on a big ball called the earth, which is always spinning round and round, and it is shone upon all the time, day and night, by the bright light called the sun.

The place where we live is like the spot on the ball, and, as the great earth-ball spins, part of the time we are on the side toward the sun and part of the time we are on the side away from the sun. When we are on that side it is dark at night, but while it is our night it is daytime for the people who live on the other side of the ball. However dark it is where we live, the sun is always shining somewhere, and the earth is always traveling toward it or away from it. The sun does not come to the earth, but the earth comes into the sunlight. If you think of the ball and the light you will understand that, however dark it is, the earth will soon carry us round into the light again.

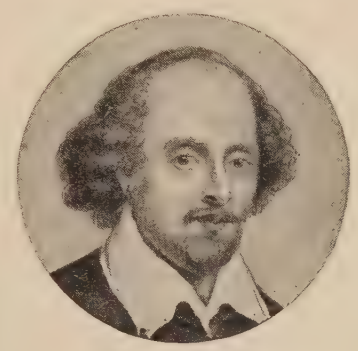
THE NEXT WONDER QUESTIONS ARE ON PAGE 185.

WHAT THIS STORY TELLS US

OH for a book and a shady nook! a man cried long ago, and in truth there is nothing to equal a book. Nothing has been able to stop the men who write books. Tyrants have burned their books and writers have been tortured by fire, but books have spread themselves throughout the world so that there is no land on earth without them now. They are the only things that live forever, for new copies are made as old ones pass away, and so through all the ages of time a book carries down the thoughts of men. A thought put into a book is stronger than a statue carved in marble, and in the story of mankind the book has been the mightiest and noblest invention conceived by the human mind. The man who writes a book can laugh at Cæsar and Napoleon; they perish while he lives on. Here we shall look at the writers of the world.

THE REALMS OF GOLD

WE are to go together on the rarest journey ever made by the mind of man through the wonderful treasure land of Literature, the glorious world of books. In this world we are going to find some of the greatest pleasure that is within anyone's reach.



Shakespeare.

To say that this is possible is no vague promise. Our greatest impulse in youth is curiosity to see and hear and know more about the world into which we have been born, to feel and think and do more, and hour by hour take to ourselves a larger share of life. And this we do first, as children, by observation, and then by activity and widening experience. But soon we shall find, or should find, that through books we can reach out, by our minds, far beyond the pleasures and knowledge we can attain through our bodily activities. And so it will be to the end of our days, however long we may live, if once we can feel the joys that await us in the great realm of bookland. We want here to make some of those joys felt by knowing of them beforehand.

All that has ever been known and felt by men, everywhere, in all the years that have been, is probably treasured up somewhere in books, marvelously preserved for our use and delight. Books live and tell us of the past when most other things have faded away.

Into books men have put their very souls as they have longed to speak their highest thoughts to those who will follow them, and perhaps be influenced by them, in long distant future ages. What the world has been is preserved in books, and the hopes of men for the future are there passed along as an everlasting inheritance for the human race.

For, on the whole, it is the best that lives in books and retains an unending power, while what is evil or what is feeble perishes and is forgotten. So the great permanent collection of books which is known as literature is constantly growing nobler—life essence distilled from the mass of men's writings.

It is because books have this splendid lasting power, age beyond age, that the great writers of them are so deeply honored. They do not belong to their own period, but to all time. They may shape the minds of innumerable millions.

In the end no man has earthly immortality except through books. The most stupendous men of action are only known at last by what has been written of them in books.

It is, then, no little thing that we do when we set out through the land of books and try to feel what can be found there that is noble and inspiring, delightful, cheering and enduringly wise.

Happily, a large part of the world's riches in literature, the books that move our spirits deeply by their truth or beauty, are to be reached through a knowledge of the English tongue. Our language is a gateway to this treasure-land.

THE BOUNDLESS RICHNESS OF THE KINGDOM OF BOOKS

Think of the boundless breadth and richness of the region we are to wander in. One great English poet, John Keats, called it the realms of gold, and pictured the reader as a traveler. So he is, for the kingdom of books has many provinces, each tempting us to enter in.

There is, for instance, the region of knowledge, the books which gather up and hold in trust for us all the wisdom and skill that generations of men have won.

There are the legends that have passed along the centuries from memory to memory, the tales of long ago that are one of the chief fountains of the world's poetry, and existed in outline before writing began. Then comes the far-reaching field of history, a vast expanse, enthralling to the observant reader, beginning with fragments from the dim past, all pieced together by careful, imaginative thought.

With writing came more flowing narratives. We have pictures of men and women who made a deep impression on others; the stately records of great events; and life stories of the writer. We read of the virtues of some leaders of men and the sins of others; the successes and failures in forms of government; and the oratory that pleads for justice and forms men's opinions. All these things have found a record in books.

THE THOUGHTS THAT HAVE FLASHED THROUGH MEN'S MINDS IN THE AGES

But not only do books, the mind's realms of gold, tell of the knowledge men have gathered slowly and picture the varied story of all that has been. They treasure up for us also the imperishable and beautiful thoughts that have flashed into men's minds throughout the ages. Being captured and expressed in lovely words, they remain as guides, and awaken in us noble impulses to be good and to spread happiness among mankind.

Through books, again, we may increase enormously our knowledge of life, seeing more of it in our minds than ever we are likely to see by our own observations. That is the chief use of novels. If novels picture life truly, they enlarge our vision and experience. If they do not picture life faithfully and wisely, they mislead and deceive us, and have a bad influence.

In stories that are truthfully imagined, and choicely told, we may see family life, the tenderness of parents, the sweetness of children, the pleasant claims of relationship, the faithfulness of true friends, the romance of love, and the firm bond of duty. Or we may penetrate the secret history of the individual soul, its high endeavors, its stern endurance, its clashing passions and rivalries, its thirst for adventures and thrilling conquests, its selfless heroism, its bold face turned to misfortune, its eager inquiries, patient virtues, its reverence before what is good and beautiful. Yes, truthful fiction fills a large place in these realms of gold.

THE HOMES OF THE FAIRIES, FAYS, NYMPHS, GNOMES, DROLLS AND GENII

It is largely in fiction that humor and laughter, those unfailing sweetnesses of life, are found. No gratitude can be too great for a combination of a humorous eye, seeing life's oddities and loving them, with a tender heart. That kind of character has made itself felt in books outside of fiction, but it shows itself with much more freedom in stories.

In them are treasured forever the gladsomeness of spirit that is seen and heard in the merry laughter and rollicking fun of the young, in the quiet smiles of the strong, and the mellowed, humorous wisdom of the aged. The world's humor is all around us in life, waiting for us to see it, but it is also condensed in the best fiction, and the observing eye is there taught what to see that will lighten the heart, and also how to see it.

It is in books, too, that we find the airy traceries of fancy which men, women and children have been shaping since the human world began. These fairy stories are woven with threads as delicate as the gossamer that bedecks the morning dew, yet are so beautiful that they will endure

forever. In this region live imaginary creatures seen and felt by millions as if they were realities—the fairies, fays, nymphs, and gnomes, the drolls and genii, the giants and monsters that once peopled the woods, streams, rocks and fountains of long ago. Here we may include also the legends made out of the half-forgotten materials of fading history and stories of the countryside as to how names, customs and beliefs arose.

THE POETRY THAT ADORNS OUR LANGUAGE FOREVER

And now, in our glance through the realms of gold, we are led to poetry, the choicest part of that wide territory. Poetry is present, more or less, in every nook of literature, though it also has a place of its own. It keeps step by step with advancing knowledge. It turns history into song. It inspires the lover of Nature, the patriot and the saint. It gives their clearest voice to Life and Love and Laughter. It is the finest expression in words of the soul of man. And so the most wondrous wealth of interest that awaits us as we travel through the world of books will be found in the poetry which, above all other writing, adorns the English language everlastingly.

We have tried to suggest how wide and welcoming and attractive is the great range of reading that we call literature; perhaps we may add a word as to how to approach and enjoy it.

In finding out what is delightful in books, we must never think we can know what is worth knowing by being told about it. We must know the books themselves and see in them those things that give it life and beauty.

A FINGER-POST TO THE HIDDEN TREASURE OF BOOKS

Whatever may be written here will be a finger-post pointing the way to the treasures of the realms of gold, but each one of us must make the journey and seek the treasure. A guide may say what to expect. He may quicken anticipation by promises of what can be found; he may show specimens; but even if every word a guide says is remembered, the reader will have failed unless the book itself is read.

Of course it is helpful to know a good deal about the interesting people who have written the books that make up fine literature. The more we know of the times in which they lived, and the circumstances in which they wrote, the better we shall understand their books. Also some directions about the purpose of a book are useful. Then we may like to know how other readers of a thoughtful kind have regarded the book, and so books about books may be welcomed rather than avoided. But from out of our own mind our opinion should come, through our reading of the book. It is only when we have seen with our own eyes, or heard with our own ears, the message sent forth in a book, in the form and with the accent the author gave it, that we can say we know the book.

One of the uses of any book, whether it be simple or great, is that it is an exercise in judgment for ourselves. We should not read to criticize with cold reproof, but to see what there is in a book that will attract, reward and delight us. And we must remember, if we are not attracted by a book that many praise, that it is quite possible the fault is in ourselves. Some great books may not attract us at first, and we may leave them for a later reading, when we pass that way again.

LET US BE HONEST WITH OUR BOOKS, AND NOT PRETEND

Let us be honest and not pretend we like what we do not really care for. But let us not be hasty and condemn what we have failed to understand. Even things of beauty do not always dawn brightly on us at once; many people have wondered, as they have grown up, how they could have missed enjoyments in books which might have been theirs years ago. The truth is, that they were not ready for them.

The reading of the finest books should never become a task. It should be a natural delight. In that spirit all the best books were written, and in that spirit they should be read. Then reading becomes the chief source of pure delight, the happiest of habits, pleasing us greatly while it enriches our minds.

What we wish to do here is to help our readers to extract from books their choicest essences, as the bee extracts honey from the flowers. Books that have delighted men for hundreds and thousands of years must have rare essences of thought and feeling in them, or they would have been neglected and forgotten. We shall wander with our readers in search of such books, to discover their inmost spirit, and enjoy together their unfailing charm.

THE NEXT STORY OF LITERATURE IS ON PAGE 215.

A FAMILIAR PICTURE OF THE LANDING OF COLUMBUS

Many artists have attempted to represent the Landing of Columbus on the little island which he called San Salvador, and this picture is familiar to many. It has been used on paper money and on a stamp. It was painted by an American artist, John Vanderlyn, by order of Congress, and hangs in the Capitol at Washington. It represents Columbus at the moment of landing, holding aloft the flag of Queen Isabella, while the natives lurk in the background. Though Columbus is one of the most famous men that ever lived, there is no picture of him which we can be entirely sure was made in his lifetime. The different pictures you see were made from descriptions of his appearance or else the artist shows him as he thinks he might have looked.

THE STORY OF GREAT LIVES

HAVE you ever thought, when looking through the window, that once upon a time there was not a pane of glass in the world? Then a man dug things out of the earth, mixed them and made something hard, smooth and clear, so that he could see through it. We call it glass. Who was he? We do not know. But let us think of the great debt we owe him as we stand at the window and look out. And all through our lives let us remember that we owe more than we can ever pay to those who lived before us—to those who wrote books and painted pictures, who discovered the power of steam and made railways, who discovered gas and lighted our houses, who made our roads, who gave us tools to work with; to the doctors who found out the secret of health, to the travelers who found new lands, to those who laid down their lives that we might live and know more and more. We shall read here of some of the greatest of these.

MEN WHO MADE THE WORLD KNOWN

WHEREVER we may be, the spot where we stand is a centre from which the whole world stretches away in all directions. What possible journeys are open to us, whichever way we may turn to make a start!

We know that by crossing the sea to the east of our land we shall reach first the British Isles, and then the continent of Europe; and that going forward, first over the land, then over the sea, we may get to Egypt and China and India and the great lands of the East. Far to the south from these we come to Australia and New Zealand, with all their people. If we turn to the north, we finally reach the desolate Arctic. South from our own continent are the many Latin-American republics; and away to the west lies the empire of Japan, where we meet the people of the East again.

It does not seem a clever thing to know all this now, but once upon a time people in Britain thought that there was no other land but theirs, and no other people but themselves. Other people in different parts of the world used to think the same thing about their countries and themselves. They did not travel from country to country as we do now, so they could not know of far-off places and different peoples. When they did begin to learn that the world had many different countries, and many different peoples, they were as surprised as we should be if we suddenly discovered the air above to be full of islands and peoples.

Men who were living where the weather is always warm had never dreamed that there were such things as snow and ice. Those who lived where the weather is always cold did not imagine that there were parts of the world where it is always summer, where oranges and grapes grow wild in the sunshine, where birds of paradise fly like living rainbows amidst the trees, and fireflies dance like winged jewels in the glowing air.

The story is told in the Book of the Earth, on page 22, of how men used to think that the earth was flat. The people of those early times did not find it easy to make their way about the world, and to discover other countries and races. Still, little by little, they did learn their way about. There were people living all round the Mediterranean Sea, and they began to move about and to find that the world was larger than they had thought. There was a wonderful people, called the Phœnicians, living in the north of Palestine. Their country ran along by the sea for a distance as great as that between Toronto and Detroit, and they built tiny ships and began to explore this great sea. They made friends with King David and King

Solomon, to whom they brought precious things from far, strange lands; they went to Greece and Spain; they even went to England. They found the way over land to India and China and Persia and parts of Africa. Just as a child learns from the information and experience of grown-up folk, each young nation, ignorant of many things at first, had to learn from older peoples. Earlier generations often lived out their lives without any idea of what lay beyond their own bounds. But the Phœnicians played the part of teacher-nation to the young races of the Mediterranean region, laying foundations of European culture. From them the Greeks, at the beginning of their development as a nation, learned about Asia and the ways of that part of the world. Later, the Romans, rising toward power, came into contact with these same traveled Phœnicians and, in turn, gathered from them knowledge of distant places.

As centuries went by, great Rome was conquered by barbarians, and then nearly all that had been learned in Europe was lost again. Men who had no idea of the value of learning destroyed all the writings that they could; and so the world was divided off much as it had been before, the people in one country knowing little or nothing about those in other countries.

Think what the world lost by this. If all the books in the world to-day were destroyed, and no more were printed for hundreds of years, people would not be able to read, and some day they would have to begin again to learn all that we know now. Something of that sort did happen in the old days, and people went on for hundreds of years before learning again what had been lost.

We shall see in our stories of discoverers and explorers how some heroes of past times found their way through strange, savage lands, and upon seas over which they had nothing to guide them. We shall enjoy the stories all the more if we can have a map or globe of the world before us. Then let us remember that no maps could have been made had not such stalwart adventurers made their discoveries and charted newly-found shores.

THE BOY WHO WALKED TO CHINA

MARCO POLO AND HIS WONDERFUL ADVENTURES

CAN you believe that it was, to a great extent, the doings of a boy which set men exploring the great seas to find their way about the world? As we have already seen, men from time to time did travel, but unless they made public what they saw and did, their knowledge was of no service to the rest of mankind. Marco Polo was only a small boy of fifteen, and not very strong, when he set out on his travels through strange lands, among savage people, to find his way to China; but when he grew up, what he had seen and known was written in a book for all men to read. His tales of strange countries and peoples, and of the riches and splendors of other lands, made other men want to go where he had been. His book told them how he had got there, so they were able to go by the route which he had followed; but it also made them determine that they would try to go by sea to the countries which he had visited.

Marco Polo went to China with his father and his uncle. Only the love of travel made them set out from their home, which was in Venice. The father and the uncle had already been to China and back, when they decided that the brave boy Marco should go with them. They had to go over mountains, and across terrible deserts, through hot burning lands, and places where the cold was terrible. Poor Marco was made quite ill by the hardships, but he got better and kept bravely on.

At last they came to China, where a great king, called Kublai Khan, was very pleased to see them. Marco, who grew up at the court and became a great favorite of the king, learned to speak several languages, and was so clever that the king sent him as his ambassador to Cochin China, to India and to other lands. Each time he came back, Marco was able to tell the king not only the answer to the message with which he had been sent, but all about the countries themselves: how the people lived, what their trades were, and what were the big cities and rivers and mountains wherever he went. The king had never had so clever an ambassador as this before, and he heaped riches on Marco, his father and his uncle.

This picture is from an old French book called The Book of Marvels, and shows the great king, Kublai Khan, seated on a throne on the backs of four elephants, as described by Marco Polo in the account of his travels.

At last the Polos wanted to return to Venice, from which they had then been absent for twenty-three years. The king was very sorry to let them go, but at last consented, and they went back. Marco remembered all he had seen and learned, and afterward he had it all written down. At first people did not believe his story to be true. They could not think it possible that there were such great lands as China and India, with millions upon millions of people. And the talk of silks and jewels and beautiful foods and scents, of which he told, seemed just as untrue. But by and by, when men began to know more, they saw that there was truth in this book. It set men studying and making bold plans for discovery. The great Columbus, who lived two hundred years afterward, was one of those who studied the book; and it was a great help to him when he was making up his mind to try to find India by sailing westward over the sea.

Marco Polo, the first European traveler to China, who walked to China as a boy and grew up at the king's court.

To show how hard it was for Marco Polo to make people believe the account of his travels, we must read the story of what happened when he and his father and his uncle got back to Venice. Nobody knew them. Nobody would believe that the little Marco Polo who had gone away as a boy had become a great traveler and come back a rich man. So the Polos asked their old friends to a great feast. First they appeared in robes of crimson satin; then they changed these for other robes, and at last they came into the room wearing the torn, soiled old clothes which they had worn in their wanderings. Their friends stared in surprise, and were still more startled when the three men cut open the patches in their old clothes and showed that these were filled with rich jewels. Then the people believed that the strangers really were the Polos, back from the far-off lands.

This is another quaint picture from The Book of Marvels. It represents Marco Polo landing at Ormuz, a once-famous city near the coast of Persia.

THE MAN WHO FOUND AMERICA

THE STORY OF CHRISTOPHER COLUMBUS AND HIS DISCOVERY

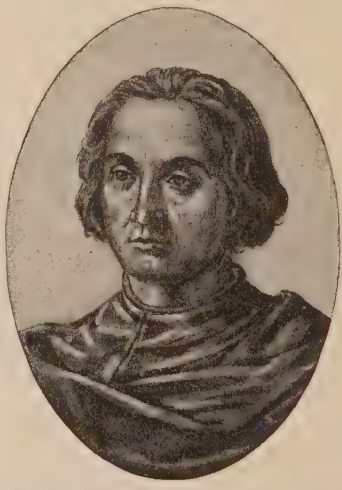
CHRISTOPHER COLUMBUS did a greater thing than he knew. He thought that he discovered India; but it was not India which he found by sailing out over the great unknown sea. It was new land—America—though he died before the country was called by that name. The discoverer never heard the name America.

Columbus was very poor as a boy, but he was clever and learned all he could about geography and travel. He was brave, too, and went to sea as far as ships commanded by other men could carry him. Once he was wrecked and almost drowned. Whenever he could, he read about Marco Polo's travels and other great adventures. He was born at Genoa, in Italy. When he grew up, he asked the rich people of his native town to provide him with a ship to go and look for new lands. For he did not believe that the earth is flat, as most people did at that time; he believed it to be round. He knew that India was far away somewhere at the back of Italy, where he lived, and he thought that it was part of a very great continent which reached far round into the sea on the other side of the world. Therefore he thought that if he sailed out across the ocean to the west he would come to the western side of India.

The people of Genoa would not have anything to do with such a scheme, so he went to Portugal and asked the king to help him. Now, this king was already sending out men and ships to explore the coast of Africa, and he thought there might be something in the plan of Columbus. But he was a bad, deceitful man, and secretly sent other men with a ship to do what Columbus had asked to be allowed to do. But the men on the king of Portugal's ship were cowards and turned back, frightened by the great sea.

The ship, named the Santa Maria, in which Columbus sailed to America. It was from the deck of this ship that the New World was first seen by men from the Old World.

When he heard what was being done, Columbus was angry and sad, and went away at once, and wrote to the king of England for help. Before anything could come of this, he went with his little son to Spain, and, though the king of Portugal sent for him to go back, he would not. He went next to a Spanish duke, who could not help him, but sent him to King Ferdinand and Queen Isabella of Spain. Spain was at war with the Moors, and the plan of Columbus was put off from time to time, until at last he went away, heavy of heart, resolved to go to France. He was so poor that he had to stop at a monastery and beg for bread for his little boy. The monks took him in and were charmed with his strange talk. One man there happened to be a friend of the Queen of Spain. He wrote at once to her, telling her how important was the plan of Columbus,



Christopher Columbus, who discovered the American continent, but thought it was part of India.

COLUMBUS BRINGING THE NEWS OF THE DISCOVERY OF AMERICA TO THE KING AND QUEEN OF SPAIN IN APRIL, 1493

Columbus began life as a poor boy, but he grew up to be received in triumph at the court of a king. He had no encouragement to set out on his great voyage of discovery until the Queen of Spain pleaded for him. Then men and ships were lent to him, and he sailed to find America. This picture shows him in the palace at Barcelona, on his return, telling the King and Queen of Spain of his discovery. It is strange to think that Columbus, who was so honored by a king, died poor and lonely, as he was born.

and she sent for Columbus to go again to court. But once more he was disappointed. He was kept waiting about the court, as the queen was engaged in games, while the man who was waiting to discover the New World was sorrowing in neglect. He set off for France at last, and then the queen knew how deeply in earnest he was and this time had him brought back, and caused three little ships to be fitted out for him.

He set sail on Friday, August 3, 1492, when he was forty-six years old. It was a strange and wonderful voyage, over an ocean which, so far as he knew, nobody else had ever sailed. His crews were terrified and wanted to turn back, and he had great difficulty in making them obey. They sailed on for two months and a week, and then, at ten o'clock on the night of October 11, 1492, Columbus saw a light shining in the darkness. He thought that land was there, and next morning he found that he was right. There before them lay a beautiful island. Columbus dressed himself in his richest clothes, and, bearing the banner of Spain, he went on shore. There he made all his crew kneel down and bless God, and kiss the ground, and give thanks for God's mercies in bringing them to this place. Columbus then claimed the Island for the king of Spain, and went on his way finding other islands. These islands he thought must be the western islands of India, because the East Indies were on the other side of the world. So he called them the West Indies, and called the people on them Indians. They were not Indians, but so they were called, and all the red men in America were called Red Indians for the same reason. It was America that Columbus had found, but he thought it was India.

This is Amerigo Vespucci, who proved that the land Columbus found was not India, but a separate continent, and after whom the land was named America.

He discovered another island, which is called Cuba, and a third, which he called San Domingo, now named Haiti.

Queen Isabella of Spain promises aid to Columbus for his voyage.

One of his ships was wrecked, so he took the wood from her and built a fort with it at Haiti. In this he left some of his men, and then returned to Spain. He was received with great honors, and soon set out again for the West. He made more discoveries of islands, and still more in a third trip. Although he had done such a great thing, Columbus was made very sad by his enemies. Men were angry because of his success, and told spiteful and false tales about him. Once he was put in chains, like a common thief. He was very poor and very lonely when he died.

America was the name given to the land after Columbus died. A man named Amerigo Vespucci explored the coast which Columbus had discovered, and found that it was not the coast of India. "It is a new world," he said. For a long time the land was called simply the New World, but at last it was decided to call it after the man who had found that it was not India. It was called America, after Amerigo, instead of being given the name of the man who found it. America was discovered by Columbus in 1492. It was not named America until 1506, the year of his death.

FINDING THE WAY TO INDIA BY SEA

VASCO DA GAMA AND THE FIRST VOYAGE ROUND THE CAPE

DURING the reign of Prince Henry the Navigator, Portugal had sent explorers out upon the seas to gather new information about those trackless highways and the lands that border them. It is probable that in the year 1460, the very year of Prince Henry's death, a new navigator was born—of noble, though not royal, blood. This was Vasco da Gama. By the time that he was a man and had proven himself a fearless mariner, there was a high task ready for him to undertake. For then at last, after years of exploring along the coast of Africa, it had been discovered that there was an end to the long mass of land. A brave sailor, Bartholomew Diaz, had discovered the southern end of the continent, the Cape of Good Hope.

This knowledge and the belief that Columbus had discovered a road to India by sailing west made the rulers of Portugal very eager to reach India by sailing east. King Manuel I, therefore, fitted out four ships and put Vasco da Gama in command of the expedition. Starting out on the voyage in July, 1497, the little fleet moved southward for months, in spite of storms and hardships that terrified the sailors. "I will never go back," said Da Gama, "until I have set foot in India." By Christmas Day they had passed the Cape and were on the eastern coast of Africa at a point which they named "Natal," in honor of Christ's natal day. Now they found a pilot to guide them through the Indian Ocean; and late in May, 1498, they arrived at Calicut in India. Nearly eleven months had they been in making the journey. After having become assured of the wealth of the country and having made efforts to establish friendly relations with the ruler of Calicut, Da Gama and his men sailed home. Only fifty-five out of one hundred and sixty men were left, but they had found out the greatly desired road to India by sea, and had opened the way for international commerce. The rich cargo of spices which they brought back and sold was the beginning of a profitable ocean trade with the East over the new highway.

Vasco da Gama, the Portuguese navigator of the fifteenth century, who was the first to sail to India round the Cape of Good Hope.

THE FIRST VOYAGE ROUND THE WORLD

MAGELLAN & DEL CANO & HOW THEY FOUND THE PACIFIC OCEAN

THE first man to sail round the world was only a lieutenant. His name was Sebastian del Cano, and when he set sail on the voyage he had for his leader the great Ferdinand Magellan. The ships went out from Spain to the west on September 20, 1519, and returned from the east on September 8, 1522, three years all but twelve days. But instead of the five ships and 270 men which had started out, there came back only one ship and thirty-one men. Del Cano was in command; the brave Magellan was dead. Let us see what had happened.

A monument to Magellan at Punta Arenas, Chile, near the straits he discovered.

After the voyages of Columbus the king of Spain still believed that India could be reached by sailing to the west. So he sent Ferdinand Magellan to seek the truth. Magellan was a Portuguese noble, who had left the service of his king because he had not been well treated. He had already gone to India by Da Gama's way, and had seen the famous Spice Islands. Now he set out to do what Columbus had failed to do—to reach India by the western passage.

He struck out boldly for what we now know as South America. Nobody had ever been able to get to the end of it; nobody could tell whether there was a way round or through it. Some of Magellan's men rose in mutiny, and one ship left him because the crew were too frightened to go farther; but he would not give up. He explored all down the coast, and at last came to a great opening into which he sailed, hoping to go right on through. No; it was only a great river. He came back, and went on until at last the coast seemed to break in two. He sailed through heavy waves into a channel which ran between great precipices. He was the only man not afraid. His men almost died of fright when a great storm arose. He managed to calm their fears, and at last they got through the strange channel. And then a magnificent open ocean appeared before them. It was smooth and calm, and he called it the Pacific, which means the "peaceful" ocean.

He had come through a strait which he called after his own name. The Magellan Straits had shown him the way past South America. It had taken thirty-eight days to get through, so it is not surprising that his men were afraid. He now sailed halfway round the world, and reached the Philippine Islands, where he was killed in a battle with the natives. After Magellan's death, Del Cano, taking the two ships fit to sail, continued the voyage, but one of these ships was abandoned in the Moluccas, and only one little vessel finally reached Europe. Del Cano came back round the Cape of Good Hope, as Da Gama had come from India. When he got home, people saw that, as he had gone out by one way and come back by another, the world really was shaped like a ball, and that Del Cano had been round it. The Straits of Magellan by their name still remind us of the man who found them a gateway to the East. Many attempts were made to follow over his adventurous course; and fifty years later Sir Francis Drake sailed round the world from England.

Del Cano, who was Magellan's lieutenant in the first voyage round the world.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 201.

WHAT THIS SECTION WILL TELL US

NATURE, a wise man said, is the mother of us all. By "Nature" we really mean the whole of life—everything that is not made by man. But many natural things, such as the sun and the moon, and the earth itself, come into other parts of our book. We are thinking now of the most important things in nature, Animal Life and Plant Life. There were plants on the earth before animals, but in this division we shall treat of animals. Elsewhere you will find the story of flowers and trees. We shall not tell our story as grown-up people do, with big words and strange names, but we shall tell what you need most to know about animals and plants, as discovered by many learned men who have given their lives to the careful study of the many kinds of living things, plant and animal, which are found upon this wonderful world of ours. We shall tell of beasts and birds; of reptiles and fishes; of animals in armor and of molluscs; of the many insects and of other forms of life.

NATURE'S WONDERFUL FAMILY

A MARVELOUS family is Mother Nature's, with thousands of children almost beyond belief. The protozoan is the very simplest form of life, all the mysteries and magic processes of existence wrapped up in a single cell. The crocodile, king of the reptiles; the oak tree, monarch of our forests; the whale, greatest of all existing animals; the elephant, lord of all the beasts that tread the ground; and man himself—all began as single cells, whether in the egg, the acorn or in the bodies of the parents.

That unseen mighty Hand which painted the flowers painted also the butterflies, gave them lustrous scales to make them equally lovely, gave them, also, their own apparatus for the creation of rich perfume to render them attractive to their fellows. All the colors of the rainbow are in the flowers, but they are repeated in the insects and again in the birds. Reptiles have many rich, strange hues, and there is luxuriant coloring for many of the mammals.

Life is made up of beauty, splendor, wonder, skill, cunning, and also of terrors we can dimly understand. To balance the song of the nightingale and the rich loveliness of a humming-bird we have the terrible deeds of the flesh-eating animals.

Every day and night myriads of herb-eating creatures must die to make meals for the carnivores. Every day, while the bee is performing her beneficent wonders in the hive, multitudes of insects are sentenced to lingering death by ichneumon flies which make nurseries of them for their eggs, from which will hatch ichneumon grubs to devour the living bodies of the insects in which the eggs are laid; and wasps carry living spiders to their nests, paralyzed but not killed, to await alive the birth and appetite of the grubs yet to be born from the wasp's eggs.

When we are kept awake at night by the noise which cats in the garden make, perhaps we wish that there were no such things as cats. Let us suppose that all the cats were sent out of this country. We know that our houses would soon be swarming with rats and mice. But something far more strange than that would happen. Soon nearly all those beautiful wild flowers called heartsease would fade away and die. We should have scarcely a heartsease left. That would be because the cats were gone.

What does the cat do to make the heartsease grow? Nothing at all. It never touches a heartsease if it can help it!

Well, why would the heartsease die if the cats were to go away? Because, if the cats went away, they could not catch the field-mice. Soon there would be so many field-mice that they would eat up all the nests of the bumblebees in the fields. Now, the bumblebees

are the little friends which make the heartsease grow. The heartsease has a sweet juice which the bumblebees love. The bumblebees fly into the heartsease to drink this juice, and in doing so they carry in with them from other plants a dust called pollen which the heartsease needs to make its seeds. If it does not get that dust, the heartsease must die. Therefore, if our gardens are to have this pretty flower, we must have cats to keep the field-mice from eating all the nests of the bumblebees. The cats do not kill all the field-mice. That would not do. They prevent the mice from becoming too many. Then, though a few mice do eat nests of the bumblebee, there are still enough bees left to bring the yellow dust to the heartsease.

That is a little thing which clever men were a long time in learning. We ought always to remember it, because it shows how nature has to plan so that the world may go on in the best way for us. When we think of the world, we think of a great place where men and women and children live. But the world was not made simply to be a home for men and women and children. If there were no living creatures but ourselves, there would be a great many empty places in the world. There would be a great deal of work left undone. There are places in the world where we cannot live.

But nature does not like empty spaces. She must have living creatures everywhere, in earth and sky and sea. And she has life everywhere.

Our eyes are not strong enough to see all the tiny things that live. If our eyes were as strong as the strongest magnifying-glasses, we should see that the air we breathe is full of very tiny creatures. We should see that the soil in the garden swarms with little insects. We should see that the little drops of water which we drink have in them more living creatures than we can count. We know that there is life in the air, as there is life in the sea. We can see the jellyfish floating on the top of the waves. We know that there are big fish and little fish beneath the surface. We know that there are monsters in the sea like whales and sharks, we know that deep down in the sea, deeper than the deepest coal-pit in the world, there are creatures such as nobody has ever seen.

So there is life everywhere, all kinds of life, as is explained in the Book of Our Own Life. Besides men and women and children, nature has many workmen, great and small, to carry on the work of the world. Some are big, like whales or elephants; some are so small that we cannot see them. Some fly in the air, some swim in the sea, some creep in the earth. Some live among us as our friends, some live wild in woods and mountains.

THE WAY WE SHALL READ ABOUT THE GREAT ANIMAL WORLD

We shall read of their wonderful ways. We shall see that all these animals, reptiles, birds, fishes, insects belong to one great family; and how, though they seem so different, they are all the same in some ways. We shall see how men have tamed wild beasts, and how all this great kingdom of animal life is subject to man, the lord of all the animals.

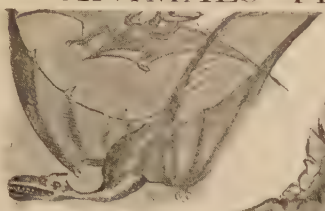
We shall take the big animals first, then the birds, then the reptiles, and after that the fishes which live in the water, the creatures that live in shells, and at last some creatures which, although they are really living animals, look like plants in the sea. The sea-lily is like a freakish plant, but it is an animal. The sea-anemone is like a lovely flower, but it, too, is an animal.

There have not always been the same sorts of animals on the earth as now. Once upon a time, when there were no men and women and children on the earth, the important living creatures were strange and monstrous animals such as we see in our pictures. These huge creatures, bigger than any animals now alive, were the masters of the earth before man came. Some were so big that they could eat off the top branches of tall trees; some of the animals could fly and swim. The animals we know came much later than these; through thousands and thousands of years the monsters were changing and passing away, until in their places we have the animals of our own time. Deep down in the rocks we now and then find remains of the monsters. Sometimes when men dig deep down, they come upon the whole body of an animal which must have died and been covered up when the rocks were being formed.

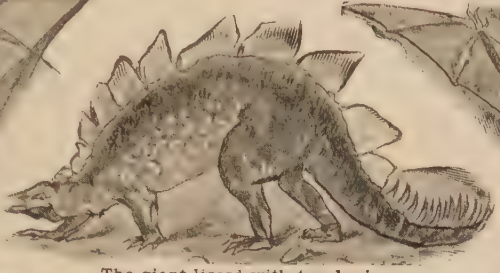
NATURE HAS BEEN PACKING HER BOX FOR MILLIONS OF YEARS

No man is clever enough to say how much time elapsed while all this was happening, but we know that at one time

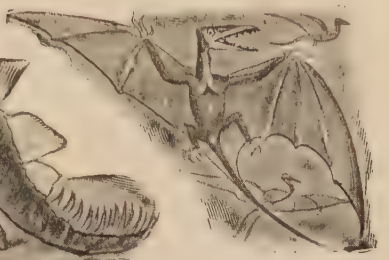
ANIMALS THAT LIVED BEFORE MAN



The flying-reptile
—the Pterodactyl.

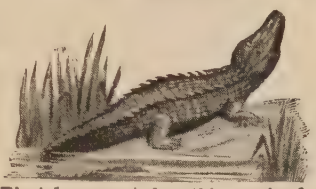


The giant lizard with two brains
—the Stegosaurus.



The flying-reptile
—the Pterodactyl.

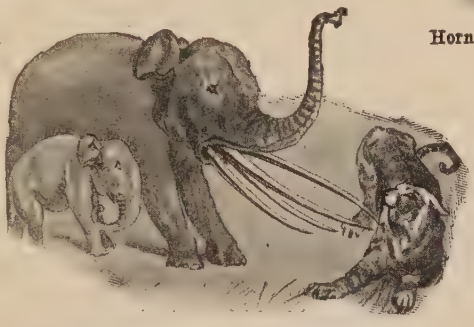
Lizard with feet like a bird
—the Iguanodon.



First known air-breathing animal
—the Archægosaurus.

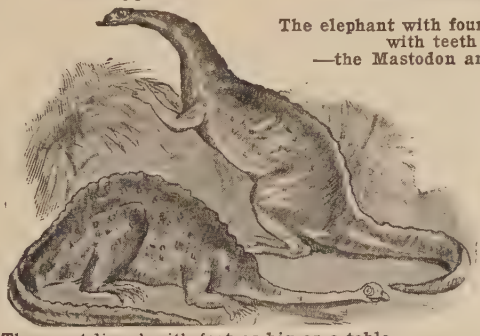
Horned animal like an antelope
—the Sivatherium.

The armadillo, like a giant
tortoise
—the Glyptodon.



The elephant with four tusks fighting the tiger
with teeth like swords
—the Mastodon and the Machairodus.

The great monster
with six horns
—the Dinoceras.



The great lizard with feet as big as a table
—the Brontosaurus.

The giant elephant that the first men fought
—the Mammoth.

The fish-lizard of the sea
—the Ichthyosaurus.

The fish-lizard with a neck like a snake
—the Plesiosaurus.

certain kinds of creatures lived on the earth or in the waters, and that after these came creatures of a different kind. There are no books to tell us these things, because there were no men alive to write books, but we find the bodies of these creatures deep down in the rocks to-day. When you unpack a box, you begin at the top, and you know that the things on the top were put into the box last, that those lower down were there before the top ones, and that the things at the bottom were put in first of all. Well, nature has been packing away things in her cellars for millions and millions of years. Her box is the solid rock. It was not always solid rock. It was mud and water. The water dried up, and as thousands of years passed, the mud grew harder and harder from heat and pressure, so that it is now rock almost as hard as iron.

How do we find the old-time animals in these rocks? They were born, and lived and died, and were covered over. Floods carried them away to the seas and lakes, where mud came swirling down with the water from the rivers. The bodies sank and were covered with layer after layer of mud. As time passed, nature dried up the seas and lakes, and, by pressure from within the earth, forced up the bed of the seas and lakes and rivers, and made it dry land. The fishes and birds and animals which had died and been buried in the mud were sealed up in this mass, and as the mud hardened into rock these creatures became part of the stone.

How we find the animals that lived long ago

When we dig deep down to-day, we find animals, birds and fishes, and even insects, many of them perfectly shaped, in the rock where they have lain for no one knows how many years. The mud which settled about them was so soft that it did not crush them out of shape. It preserved their shape, as it preserved the shape of the beautiful ferns printed in the coal. Some of the big things were just as carefully protected by the mud, without being turned to stone. Great animals, like the mammoth, which was a sort of huge elephant covered with long hair, died many, many years ago through sinking into deep mud in Siberia, and became frozen hard in that mud; and some of these have been found lately with flesh and skin and hair all preserved. Many of these are found in what were swamps near the mouths of rivers. Sometimes the courses of the rivers were changed, and the ice melted. For hundreds of years the natives have been selling the tusks of the mammoths for ivory. Hundreds of these huge animals have been found in several different parts of the world.

Of course, not all the creatures that were once alive have been preserved in this way. Many were destroyed in various ways after their death, but there still remains enough to show us what creatures of long-ago were like, and to tell us to what families those now on the earth are most closely related.

What the first of all birds looked like

The oldest bird known is called the archæopteryx. That is a Greek word, which really means "ancient wing." It was an extraordinary bird. It had a long tail, not all feathers as a bird's tail is now, but like a lizard's tail, long and thick, with bones and flesh, and with feathers growing from it. It had two legs with which it could walk or perch in the trees, but it had two other limbs with fingers which it probably used for climbing, as well as to fly about the trees from bough to bough as birds now do. It had a curious eye fitted with a sort of armor-shield as the reptiles have, and its beak was armed with great strong teeth.

Of course, there is no such bird as this now, and it is not surprising that such a bird should pass away. Even in these days two or three strange birds have died out. The dodo was quite common in the island of Mauritius not so many years ago, but there is not one alive to-day in all the world, although we may see the skeleton of one at the great museum in London. It could not fly because its wings were so small, and the dodo family was soon all killed. In New Zealand there used to be vast numbers of birds called moas, which were twice as high as the tallest man—as much as fourteen feet high. There still lives in New Zealand a bird called the apteryx, or kiwi, which, like the moa and the dodo, and the ostrich and the penguin, cannot fly; but though it is a fair-sized bird, it is tiny compared with the moa. The great auk, which used to come in thousands to the shores of Newfoundland, is

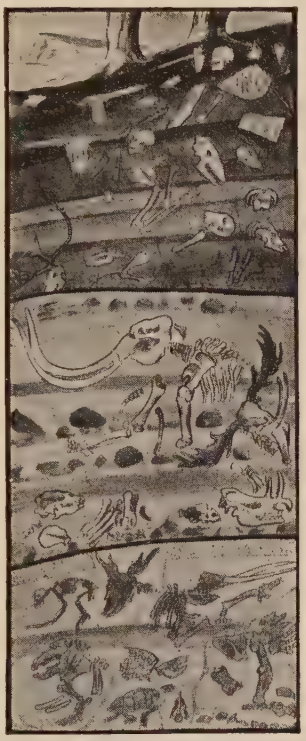
another bird which has died out within the last hundred years. There is not one in the world to-day, but there are a few of its eggshells, and they are so rare that the different museums pay hundreds of dollars for them.

Men have killed many birds and animals, but in making the world what it now is, nature has killed far more. Whole races of animals have been destroyed by earthquakes and floods, by the sinking of land into sea, and by snow and frost and ice descending upon lands where before all was sunshine and rich vegetation. Then again, great families of animals have gradually died out and given place to others better able to fight the battle of life.

Think of the horse—that swift and beautiful creature! Once upon a time, long before man appeared on the earth, we are told that the horse was a miserable little thing, with five toes on its front feet and three behind, and only as big as a fox. The horse has, through a long number of years, become larger and swifter and more beautiful, and its soft, spreading toes have become hard hoofs.

Think, again, of the humming-bird, that tiny beauty not much bigger than a good-sized bee. Compare it both in size and in beauty with a monster called the iguanodon, which had a great head like a lizard, a yard in length. It had a great tail and enormous hind legs, with shorter ones in front; and when it reared itself upon its hind legs, the height of its head from the ground was fourteen feet. In many ways it was like a bird.

There were others rather like it which ate flesh. One of these was a fearful creature called the megalosaurus, which fed upon the flesh of the great animals that lived on herbs. Another was called the brontosaurus, and a third was called the ceteosaurus. These monsters had bodies as big as the biggest elephants. Their legs were shaped like those of the iguanodon, except that the front legs were longer. The length of these creatures was as much as eighty feet; and their backs, when they were full grown, were quite fourteen feet from the ground. All these creatures belonged to a family called the dinosaurs, which means "terrible lizards."



BURIED ANIMALS

We know that huge monsters once lived, because when we dig deep down we find their bodies buried in the earth, where they have lain for millions of years.

The sea, as we have seen, had wonderful creatures in those far-off days. The waters teemed with what we now call the great fish-lizards. One of these, the ichthyosaurus, was about forty feet long. It had a wonderfully formed eye which it could adjust so as to see things quite near or those far away. The remains of this creature are common in England and in some parts of Germany; and scientists have been able to learn that though its home was chiefly in the water, it used to crawl on to the land to bask in the sun, as turtles and seals still do. The ichthyosaurus has died out, but the shark lives as a relic of those bygone times. The whale is a much younger creature.

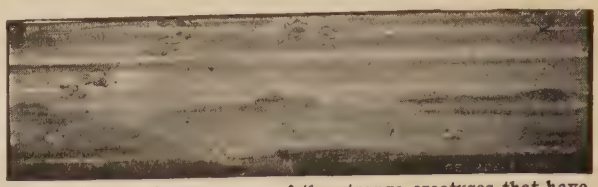
The sloths, small animals to-day, which cling to the branches of trees and live upside down, are descended from enormous creatures which, instead of having to climb the trees to eat the tender shoots, were powerful enough to pull the tree down to their mouths! The bodies of these monsters were as big as elephants, and their front legs had enormous power. Similar to the great sloth was an animal called the mylodon, the remains of which have been found in a huge cave in Patagonia, along with the bones of other wild animals. It must have been buried there a very great time ago, for among the bones were those of animals now extinct. In this cave there were also the bones of dogs and men, together with bones made sharp by man to use, perhaps, as dinner-forks; and here also was found a quan-

tity of cut grass, which makes us believe that once upon a time savages kept the mylodon alive in the cave and fed it with grass.

Nearly all of these extinct monsters made their home at one time in North America. We know that once the whole interior of the continent was covered with water, in which swam huge fishes and enormous reptiles, as well as many smaller sorts. On the shores roamed tigers with long tusks, lions bigger than any now to be found, great bears which lived in caves, rhinoceroses covered with wool, and herds of hippopotamuses. In various parts of North America and of Europe were gazelles, great wild cattle and little wild horses, beavers, raccoons, leopards, lynxes, and cats, such as are now known only as Egyptian cats. There were crocodiles and alligators in enormous numbers in the rivers, and wild hunting-dogs and wolves in the woods and forests. We find remains of such things as these in quarries and coal-pits, and in deep cuttings when railways are laid or where wells are sunk. Animals that now live only in the coldest parts of the earth once lived in the far South, and animals that can live only in hot climates once lived here. From this we see how great have been the changes in the climates of this country in bygone ages; and this helps us to understand one way in which animals from time to time have come to their end.

These great animals once upon a time had the world to themselves. They were the masters of the earth. They disappeared in the ways we have seen, and in many other ways. Many of them were destroyed by the Great Ice Age, of which we read in the story of North America on another page of our book, when the climate of a great part of the world was suddenly changed, and nearly all living creatures perished from cold.

All these things about the

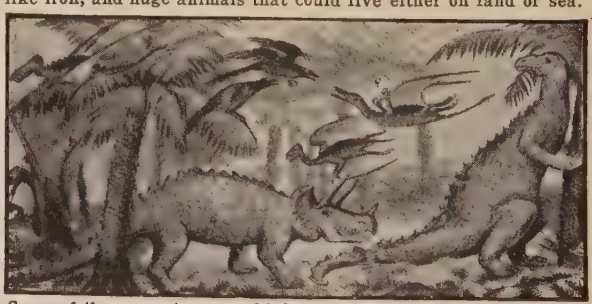


These pictures show us some of the strange creatures that have passed away, and help us to understand the story of animal life from the beginning. Once all creatures lived in the sea, and some of them were only soft things like jelly, with no bones.

These creatures had the sea to themselves for a very long time, and slowly they grew into separate families. Proper fishes began to swim about, and some of them lived in shells. Then on the land great forests grew, and a new kind of animal came.

The first crocodile appeared now, but this age is important because great trees grew, drinking in the sunshine for thousands of years, and then fell, to be buried in the earth and to lie there millions of years, until they turned to coal. That is how coal began.

In the sea fish-lizards grew, four times as long as a man, some with necks like snakes; also great sea-serpents, fish with skins almost like iron, and huge animals that could live either on land or sea.



Some of these creatures could fly and swim, and some could eat off tree-tops. The first birds came, and flying-dragons. Millions of years later these animals were replaced by the birds we know.

On the land great monsters were growing up, and the mastodon, like a giant elephant with four tusks, fought the tiger with teeth like swords. There were bats in those days, and a strange little animal walked the earth which we may, perhaps, call the first horse.

The little sloths we see to-day have descended from creatures like that clasping a tree on the right. The giant sloth lived when the hippopotamus and elephant began, when there were horses with many toes, and animals like tortoises bigger than a man.

Slowly the world grew into the kind of place it is now, and the animals became more like those we know. Bears lived in caves, and the woolly rhinoceros and the savage hyena roamed the earth with the mammoth, like a giant elephant with long hair.

At last came man, the lord of all the animals. The earliest traces of man on earth show that he killed animals with stone weapons, and made fires in the caves in which he often lived. It has taken thousands of years for him to learn how to build houses, work metals, print books, and to do the many thousand other things which we take as a matter of course to-day.

SOME OF THE GREAT MONSTERS OF THE PAST

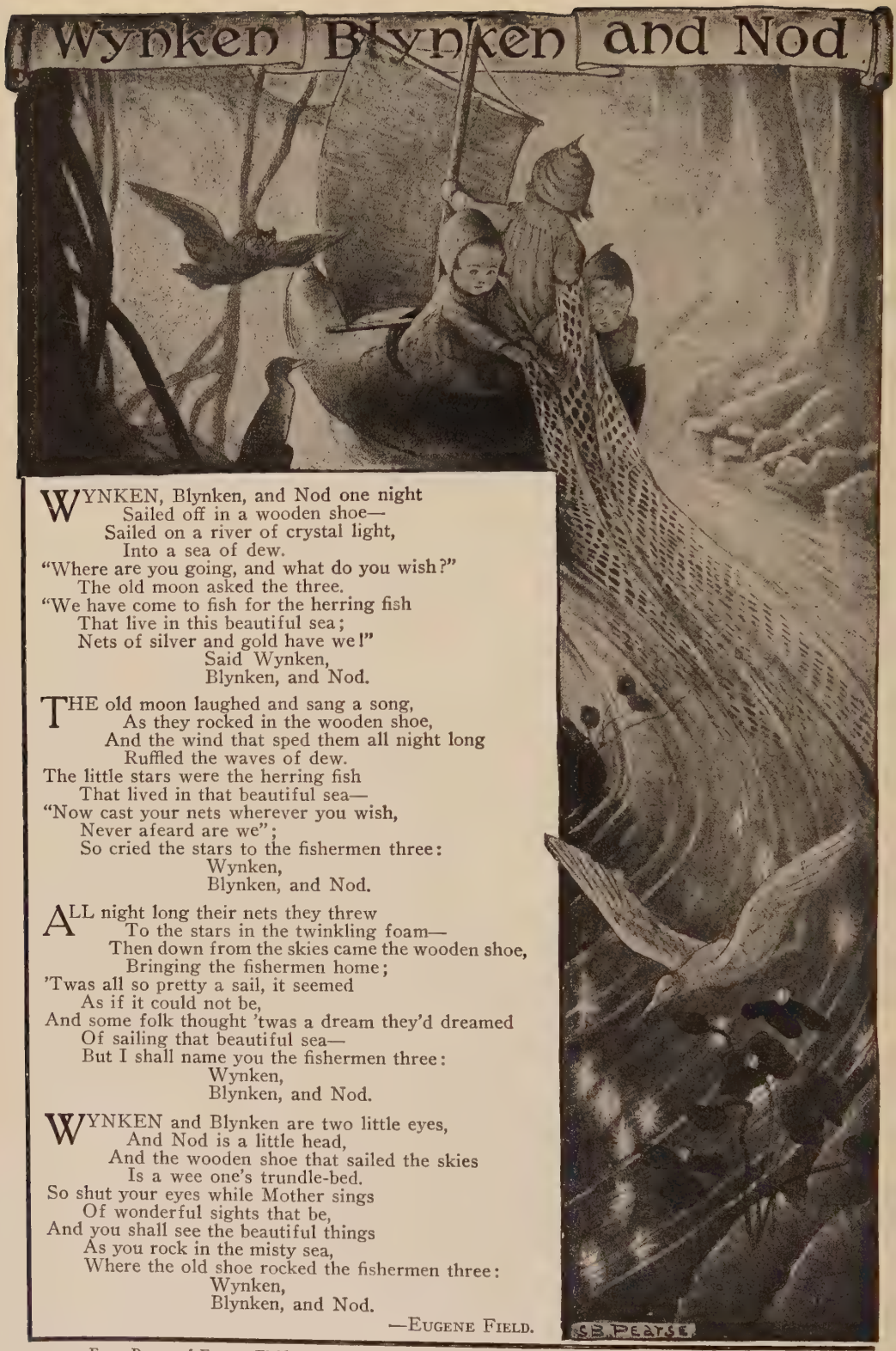
early world we learn from nature's own storehouses, the rocks and bogs or the frozen wastes in which the strange monsters of land and sea fell and died, and in which they have been preserved for us. The great fish-lizards are no more, the monstrous flying-reptiles have gone. The gigantic birds are represented only by the ostrich and the emu. But there are still links with the puzzles of those old days. There is still an animal that flies—the bat; and there is still an animal that lays eggs like a bird and has a beak like a duck. It is called the platypus, and it lives in Australia, where that strange animal the kangaroo, looking like some of the Old World freaks, is also to be found. The great sloth has come down to very small size, though some people believe that there are still monstrous ones alive in Patagonia. The bats, with their wings and claws and mouselike bodies, remind us of the curious things of old time, and the lizards and the armadillos tell us of a time when their ancestors were among the marvels of the world.

What is the use of all these animals? That is what we often ask ourselves. All things really have their uses. One of the most important is to keep the world in a sort of balanced condition.

There is nothing more ugly at the zoo than the alligators and crocodiles. They are cruel creatures, and have to be killed when we catch them, because, when they can, they eat men. Yet we cannot afford to lose them, for they eat things which destroy the crops, and the dead bodies of animals drowned in the rivers. If the alligators did not eat them, these bodies would poison the rivers. The great hippopotamus also eats the things which grow in the rivers. If he did not, many rivers would become choked with weeds.

NEXT STORY OF ANIMAL LIFE IS ON PAGE 207.

Wynken Blynken and Nod



WYNKEN, Blynken, and Nod one night
Sailed off in a wooden shoe—
Sailed on a river of crystal light,
Into a sea of dew.
"Where are you going, and what do you wish?"
The old moon asked the three.
"We have come to fish for the herring fish
That live in this beautiful sea;
Nets of silver and gold have we!"
Said Wynken,
Blynken, and Nod.

THE old moon laughed and sang a song,
As they rocked in the wooden shoe,
And the wind that sped them all night long
Ruffled the waves of dew.
The little stars were the herring fish
That lived in that beautiful sea—
"Now cast your nets wherever you wish,
Never afeard are we";
So cried the stars to the fishermen three:
Wynken,
Blynken, and Nod.

ALL night long their nets they threw
To the stars in the twinkling foam—
Then down from the skies came the wooden shoe,
Bringing the fishermen home;
'Twas all so pretty a sail, it seemed
As if it could not be,
And some folk thought 'twas a dream they'd dreamed
Of sailing that beautiful sea—
But I shall name you the fishermen three:
Wynken,
Blynken, and Nod.

WYNKEN and Blynken are two little eyes,
And Nod is a little head,
And the wooden shoe that sailed the skies
Is a wee one's trundle-bed.
So shut your eyes while Mother sings
Of wonderful sights that be,
And you shall see the beautiful things
As you rock in the misty sea,
Where the old shoe rocked the fishermen three:
Wynken,
Blynken, and Nod.

—EUGENE FIELD.

From Poems of Eugene Field, copyright, 1910, by Julia S. Field, published by Charles Scribner's Sons.
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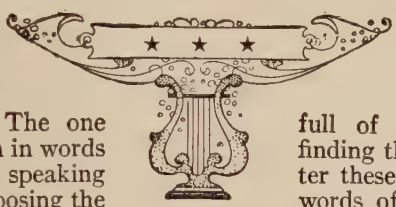
WHAT POETRY REALLY IS

JUST as colors and brushes and pencils are not painting, but merely the means of it, so rhyme and metre are not poetry but only rules for its expression. What is poetry then, really? And what is painting? And why are they both called arts? Poetry is word-painting of some of the beauty that is in the world, just as painting is color and line picturing of it. Music is a sister art expressing, by tones instead of metre or color, the beauty of sound. Music and poetry are very closely related because they are both ruled by metre or time. As we grow bigger, we perceive more and more the beauty of this world wherein we live. We see the beauties of nature displayed for us in her seasons and in her moods. We find color in a sunset, form in a tree, music in a water-fall. Poetry, painting, music can express all these for us. There is beauty, besides, in human nature, the love and sacrifice of mothers, the courage and endurance of brave men, the high dreams of teachers and prophets.

POETRY THE MUSIC OF WORDS



THERE are two ways of writing a story, or telling about a place or a thing or an event. The one way is to write it down in words like those we use in speaking one to another, but choosing the words more carefully, so that they will give as good an idea of what we have seen or thought as words can give. This kind of writing is called prose. The words and sentences used by great writers are so well chosen and arranged that they give us a clear idea of what has been in the writer's mind, and in reading them aloud we find that they have a fine and pleasing sound.

But there is another kind of writing, in which the words and sentences used by the writers sound far sweeter and more musical than the words of prose. This we call poetry, and those who write it are called poets.

Prose is used to tell almost any kind of story, or to describe anything; but there are grand things in history, beautiful scenes in the world, noble thoughts in the minds of men, that can be better described in poetry.

Poetry began, very likely, with the desire for singing, which comes when we are very happy or after a success of any kind. Long ages ago, when our far-off forefathers could not even read or write, they had poets who went with them into battle, and after the victory these poets, or bards, as they were called, would compose verses of fine-sounding words to celebrate the victory. These verses they sang while they played a harp. In this way poetry began, perhaps, men having their minds full of happy thoughts, and finding that they could best utter these thoughts by choosing words of musical sound. Homer, one of the greatest of poets, was a blind Greek who lived more than 800 years before Christ. He used to recite in public places in Greece his poetical descriptions of the wars of the Greeks.

There are three kinds of poetry. There is dramatic poetry, which is written in the form of people speaking to each other, as in the plays of Shakespeare. Then there is epic poetry, which is usually a description of some great event, a hero, or the history of a nation, told in grand, noble words. The third kind is called lyric poetry, from the fact that it was originally intended to be sung to the playing of a lyre, which is a very ancient musical instrument somewhat like a harp. All beautiful songs come into lyric poetry.

Another thing to know is that poetry is written sometimes in rhymed lines and sometimes without rhymes. A rhyme means that similar sounds occur at the ends of lines, though the words are different. Here is one, with the sound that makes the rhyme printed in different type:

The world is so full of a number of th*ings*,
I'm sure we should all be as happy as k*ings*.

If you count the syllables in these two lines you will find that both have

eleven. There should always be a certain number of syllables in a line of poetry, but the number will depend on the plan the poet has arranged. Your ear should always tell you when there are too many or too few.

How the poets make their rhymes

The words in which the same sounds occur need not be in following lines, but can be placed in all sorts of different ways. The rhymes in the verse below are alternate, which means that each line ends with the same sound as the next line but one after it:

Arabia's desert-*ranger*
To Him shall bow the knee,
The Ethiopian st*ranger*
His glory come to see.

And here is another form of verse, in a tiny poem by Robert Louis Stevenson, in which half of the lines rhyme, while the other half have no rhymes:

The rain is raining all around,
It falls on field and tr*ee*,
It rains on the umbrellas here,
And on the ships at *sea*.

The only advantage of rhyme is that it pleases the ear and helps us to remember all the words of the poem, but it is not poetry in itself, and much of our finest poetry has no rhymes in it.

When a poem has no rhymes it is called blank verse, and most of Shakespeare's works, and Milton's also, were written in this kind of verse, full of grand-sounding words and of lines that would have been far less noble and dignified if every two of them had ended with similar sounds.

Poems that do not need rhymes

For this reason nearly all poems about great events, tragedies, the deeds of noble men and women, are written in blank verse, which is more suited to those stories than rhymed verse. Here is an example of blank verse from Shakespeare's description of Brutus:

His life was gentle; and the elements
So mix'd in him, that Nature might stand up,
And say to all the world, This was a man!

How fine these lines sound! They have the solemn music of a grand organ and need no rhyme; but each line must balance with the others in syllables and accent. Lyric poetry, in which the lines usually rhyme with each other, is oftenest used to describe the lighter and happy side of life, and in the Book of Poetry it will nearly always be this happy side of life which we shall hear about from the poets.

English poetry has a very long history, and was first written by men when our language was so different from what it is to-day that it looks almost like a foreign tongue when we see it printed now. But we will not go so far back to seek for poems among the works of the old writers. The first really great poet that lived in England was Geoffrey Chaucer, and no boy or girl could read the poems which he wrote unless they were turned into modern English. Even then they are not very well suited to young readers, and for this reason we shall take very little, if anything, from Chaucer, who died more than five centuries ago. After his death, for many years there was not much good poetry written in England, and his is the one really great name that stands out among the poets of the Middle Ages.

Greatest of all the poets in the world, William Shakespeare

The English language in those far-off days was going through many changes, and it was just about the time when Queen Elizabeth began to reign that it had become one of the finest languages in the world in which to write either good prose or poetry.

Our language has not changed very greatly since the days of Elizabeth, so that William Shakespeare, the wonderful poet who was born in her reign and became the greatest poet of his age, and the greatest ever born in England, used very much the same language as Tennyson, who lived just before your time, nearly three hundred years later. For this reason Shakespeare is to be thought of as a writer of what we call modern English, and in his poems we shall find that our language is used in the most beautiful way.

We might begin our readings in the wonderful book of English poetry with a number of poems and passages from Shakespeare; but perhaps young readers will prefer to have different poems from different poets in each part, and thus to become acquainted with many as soon as possible. So, like bees in a rich garden, we shall go from flower to flower gathering our honey as we choose.

MY SHADOW*

We often have fancies that come to our minds at odd times, but only the poet can lay hold of these fancies and keep them for the delight of all who may read. My Shadow is an example of this. We must all, in our young days, have had some such thoughts, but only Robert Louis Stevenson, who wrote this pretty poem, was clever enough to turn these thoughts into words that can live.

I HAVE a little shadow that goes in and out with me,
And what can be the use of him is more than I can see.
He is very, very like me from the heels up to the head;
And I see him jump before me when I jump into my bed.

The funniest thing about him is the way he likes to grow—
Not at all like proper children, which is always very slow;
For he sometimes shoots up taller, like an indiarubber ball,
And he sometimes gets so little that there's none of him at all.

He hasn't got a notion of how children ought to play,
And can only make a fool of me in every sort of way.
He stays so close beside me, he's a coward, you can see;
I'd think shame to stick to nursie as that shadow sticks to me.

One morning, very early, before the sun was up,
I rose and found the shining dew on every buttercup;
But my lazy little shadow, like an arrant sleepy-head,
Had stayed at home behind me, and was fast asleep in bed.

ARMIES IN THE FIRE*

Looking into the fire at night when all is still and only the burning coals sputter and crackle what strange pictures we seem to see! Did you ever see an army marching in the fire? That is what R. L. Stevenson once fancied he saw, and in this poem he paints his fancy over again in words. This poem, like My Shadow, and other of Stevenson's verses which we shall print, is taken, by permission of Messrs. Longmans, Green & Co., from A Child's Garden of Verses.

THE lamps now glitter down the street;
Faintly sound the falling feet;
And the blue even slowly falls
About the garden trees and walls.

Now in the falling of the gloom
The red fire paints the empty room;
And warmly on the roof it looks,
And flickers on the backs of books.

Armies march by tower and spire
Of cities blazing in the fire—
Till, as I gaze with staring eyes,
The armies fade, the lustre dies.

Then once again the glow returns;
Again the phantom city burns;
And down the red-hot valley, lo!
The phantom armies marching go.

Blinking embers, tell me true,
Where are those armies marching to,
And what the burning city is
That crumbles in your furnaces?

*From The Complete Poems of Robert Louis Stevenson, copyright, 1905, 1923, by Charles Scribner's Sons. By permission of the publishers.

THE BROOK

This is one of the most beautiful of all Alfred Tennyson's poems. We fancy we can hear the brook speaking as we read these verses, and if you will sit beside a brook and read them you will come to feel something of the music and poetry of nature, and the sound of the running brook will seem, in your ears, a song of joy. It is a poem of natural joy, and was written as part of a longer poem, but is complete in itself.

I COME from haunts of coot and hern,
I make a sudden sally,
And sparkle out among the fern,
To bicker down a valley.

By thirty hills I hurry down,
Or slip between the ridges,
By twenty thorps, a little town,
And half a hundred bridges.

Till last by Philip's farm I flow
To join the brimming river,
For men may come and men may go,
But I go on for ever.

I chatter over stony ways,
In little sharps and trebles,
I bubble into eddying bays,
I babble on the pebbles.

With many a curve my banks I fret
By many a field and fallow,
And many a fairy foreland set
With willow-weed and mallow.

I chatter, chatter, as I flow
To join the brimming river,
For men may come and men may go,
But I go on for ever.

I wind about, and in and out,
With here a blossom sailing,
And here and there a lusty trout,
And here and there a grayling,

And here and there a foamy flake
Upon me, as I travel
With many a silvery waterbreak
Above the golden gravel,

And draw them all along, and flow
To join the brimming river,
For men may come and men may go,
But I go on for ever.

I steal by lawns and grassy plots,
I slide by hazel covers;
I move the sweet forget-me-nots
That grow for happy lovers.

I slip, I slide, I gloom, I glance,
Among my skimming swallows;
I make the netted sunbeam dance
Against my sandy shallows.

I murmur under moon and stars
In brambly wildernesses;
I linger by my shingly bars;
I loiter by my cresses;

And out again I curve and flow
To join the brimming river,
For men may come and men may go,
But I go on for ever.

THE ENCHANTED SHIRT*

This poem by John Hay, an American author and statesman, tells of a discontented, ill-tempered king, whose wisest doctor said he could only get well by sleeping one night in the shirt of a happy man. Couriers were sent to hunt throughout his kingdom for a happy man, but the only man who was happy was so poor that he had no shirt at all. Thus was the rich, discontented king made to feel shame, and to realize that a contented mind is far better than great possessions.

THE King was sick. His cheek was red,
And his eye was clear and bright;
He ate and drank with a kingly zest,
And peacefully snored at night.

But he said he was sick, and a king should know,
And doctors came by the score;
They did not cure him. He cut off their heads,
And sent to the schools for more.

At last two famous doctors came,
And one was as poor as a rat;
He had passed his life in studious toil,
And never found time to grow fat.

The other had never looked in a book;
His patients gave him no trouble;
If they recovered they paid him well,
If they died their heirs paid double.

Together they looked at the royal tongue,
As the King on his couch reclined;
In succession they thumped his august chest,
But no trace of disease could find.

The old sage said, "You're as sound as a nut."
"Hang him up!" roared the King, in a gale—
In a ten-knot gale of royal rage.
The other leech grew a shade pale.

But he pensively rubbed his sagacious nose,
And thus his prescription ran—
The King will be well if he sleeps one night
In the shirt of a Happy Man.

. . . . . .

Wide o'er the realm the couriers rode,
And fast their horses ran;
And many they saw, and to many they spoke,
But they found no Happy Man.

At last they came to a village gate,
A beggar lay whistling there;
He whistled and sang and laughed and rolled
On the grass in the soft June air.

The weary couriers paused and looked
At the scamp so blithe and gay;
And one of them said, "Heaven save you, friend!
You seem to be happy to-day."

"O yes, fair sirs!" the rascal laughed,
And his voice rang free and glad;
"An idle man has so much to do
That he never has time to be sad."

"This is our man," the courier said;
"Our luck has led us aright;
I will give you a hundred ducats, friend,
For the loan of your shirt to-night."

The merry blackguard lay back on the grass,
And laughed till his face was black;
"I would do it, God wot," and he roared with the fun,
"But I haven't a shirt to my back."

*Copyright, 1871, 1880, 1899, by John Hay.

Each day to the King the reports came in
Of his unsuccessful spies,
And the sad panorama of human woes
Passed daily under his eyes.

And he grew ashamed of his useless life,
And his maladies hatched in gloom;
He opened his windows and let the air
Of the free heaven into his room.

And out he went in the world and toiled
In his own appointed way;
And the people blessed him, the land was glad,
And the King was well and gay.

A FAREWELL

Charles Kingsley was a clergyman and novelist. Many of his stories have become famous and are standard works of fiction. He was also a writer of poetry, and this is one of the best known of his smaller poems. It was written for a girl as farewell advice. Like all good people, he loved children very much, and delighted to write for them. The poem reminds us that it is better to be good and to do good and noble things than to be clever and win fame and fortune. A Farewell is printed here by permission of Messrs. Macmillan, publishers.

MY fairest child, I have no song to give you;
No lark could pipe in skies so dull and gray.
Yet, if you will, one quiet hint I'll leave you,
For every day.

I'll teach you how to sing a clearer carol
Than lark who hails the dawn o'er breezy down,
To earn yourself a purer poet's laurel
Than Shakespeare's crown.

Be good, sweet maid, and let who can be clever;
Do noble things, not dream them, all day long,
And so make Life, Death, and that vast Forever
One grand, sweet song.

THE DAFFODILS

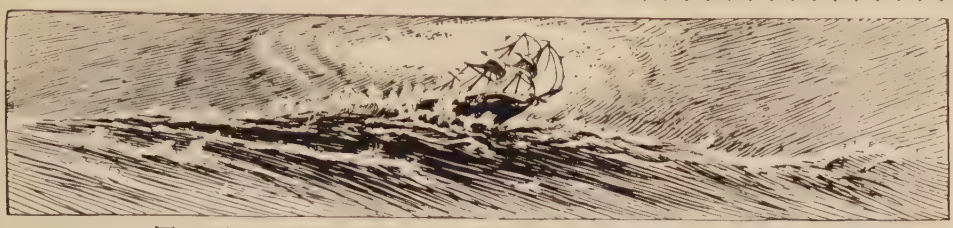
William Wordsworth was one of the greatest English poets, and this poem is one of the many pieces in which he writes, clearly and lovingly of nature and the beauties of flower-land. It was written a little more than one hundred years ago, after the poet had seen a wonderful blow of golden daffodils on the shores of Lake Ullswater, not far from where he lived. The last four lines mean that the recollection of beautiful things seen with our own eyes is one of life's greatest joys.

I WANDERED lonely as a cloud
That floats on high o'er vales and hills,
When all at once I saw a crowd,
A host of golden daffodils:
Beside the lake, beneath the trees,
Fluttering and dancing in the breeze.

Continuous as the stars that shine
And twinkle on the milky way,
They stretched in never-ending line
Along the margin of a bay:
Ten thousand saw I at a glance,
Tossing their heads in sprightly dance.

The waves beside them danced, but they
Outdid the sparkling waves in glee:
A poet could not but be gay,
In such a jocund company;
I gazed—and gazed—but little thought
What wealth the show to me had brought.

For oft, when on my couch I lie
In vacant or in pensive mood,
They flash upon that inward eye
Which is the bliss of solitude;
And then my heart with pleasure fills,
And dances with the daffodils.



THE WRECK OF THE HESPERUS

A BALLAD means a story in verse, and should always be told in a plain, straightforward way. This beautiful poem by H. W. Longfellow is one of the finest ballads we could choose. The tragic story of the wreck of the vessel, the picture of the raging storm, the finding of the drowned child—all is told without waste of words, but in just the very words that mean most and stir the imagination of the reader.

IT was the schooner Hesperus,
That sailed the wintry sea;
And the skipper had taken his little daughter,
To bear him company.

Blue were her eyes as the fairy-flax,
Her cheeks like the dawn of day,
And her bosom white as the hawthorn buds,
That ope in the month of May.

The skipper he stood beside the helm,
His pipe was in his mouth;
And he watched how the veering flaw did blow
The smoke now west, now south.

Then up and spake an old sailor,
Had sailed the Spanish Main:
"I pray thee, put into yonder port,
For I fear a hurricane.

"Last night the moon had a golden ring,
And to-night no moon we see!"
The skipper, he blew a whiff from his pipe,
And a scornful laugh laughed he.

Colder and louder blew the wind,
A gale from the north-east;
The snow fell hissing in the brine,
And the billows frothed like yeast.

Down came the storm, and smote amain
The vessel in its strength;
She shuddered and paused, like a frighted steed,
Then leaped her cable's length.

"Come hither! come hither! my little daughter,
And do not tremble so;
For I can weather the roughest gale,
That ever wind did blow."

He wrapped her warm in his seaman's coat
Against the stinging blast;
He cut a rope from a broken spar,
And bound her to the mast.

"O father! I hear the church-bells ring,
O say, what may it be?"
"'Tis a fog-bell on a rock-bound coast!"—
And he steered for the open sea.

"O father! I hear the sound of guns,
O say, what may it be?"
"Some ship in distress, that cannot live
In such an angry sea!"

"O father! I see a gleaming light,
O say, what may it be?"
But the father answered never a word,
A frozen corpse was he.

Lashed to the helm, all stiff and stark,
With his face turned to the skies;
The lantern gleamed through the gleaming snow
On his fixed and glassy eyes.

Then the maiden clasped her hands, and prayed
That saved she might be;
And she thought of Christ, who stilled the waves
On the Lake of Galilee.

And fast through the midnight dark and drear,
Through the whistling sleet and snow,
Like a sheeted ghost, the vessel swept
Towards the reef of Norman's Woe.

And ever, the fitful gusts between,
A sound came from the land;
It was the sound of the trampling surf,
On the rocks and the hard sea-sand.

The breakers were right beneath her bows,
She drifted a weary wreck,
And a whooping billow swept the crew
Like icicles from her deck.

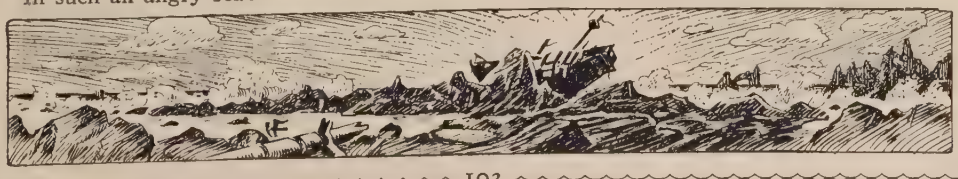
She struck where the white and fleecy waves
Looked soft as carded wool,
But the cruel rocks, they gored her side,
Like the horns of an angry bull.

Her rattling shrouds, all sheathed in ice,
With the masts, went by the board;
Like a vessel of glass, she stove and sank,
Ho! ho! the breakers roared!

At daybreak, on the bleak sea-beach,
A fisherman stood aghast,
To see the form of a maiden fair,
Lashed close to a drifting mast.

The salt sea was frozen on her breast,
The salt tears in her eyes;
And he saw her hair, like the brown seaweed,
On the billows fall and rise.

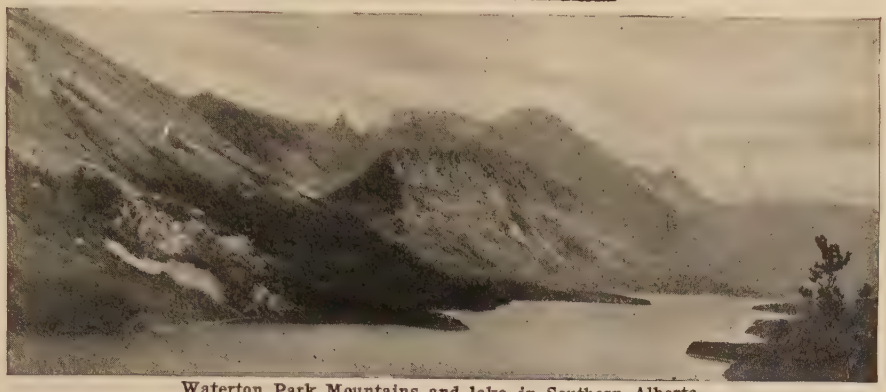
Such was the wreck of the Hesperus,
In the midnight and the snow!
Christ save us all from a death like this
On the reef of Norman's Woe!



NATURE'S OWN SOLEMN PILLARS

Photo, courtesy of the Canadian Pacific Railway.

Stanley Park is one of the chief attractions of Vancouver. It is situated on the end of the peninsula on which the principal part of the city lies, and contains nearly a thousand acres. Some of the finest trees in North America grow here, and this group is called "The Cathedral," from the similarity of their great, towering trunks to the stone columns that support the roof of a great church.



Waterton Park Mountains and lake in Southern Alberta.

THE DOMINION OF CANADA

HILL AND VALLEY, LAKE AND RIVER

THE Dominion of Canada means nearly all the land in the northern half of the continent of North America. It also includes most of the islands that stretch to the North Pole. Alaska on the northwest, Newfoundland, part of Labrador and the small islands, St. Pierre and Miquelon on the east coast, are not included. Even with these exceptions Canada's land surface is greater than that of the United States with Alaska.

It is hard to imagine how vast is this northern Dominion. But we do get an idea of its size when we know that a fast train, flying along at great speed, takes more than five days and five nights to cross from the Atlantic coast to the Pacific coast. A man walking at the rate of ten miles a day would take a whole year to go from Halifax in Nova Scotia to Vancouver in British Columbia. On his journey he would see many kinds of scenery. Rolling wooded hills, pleasant fruitful valleys, forested small mountains, swift rivers, broad lakes, far-stretching plains and gigantic mountains towering to the clouds would meet his eyes. In the winter he would have to walk briskly, for he would meet with many cold days when he would have to travel in the snow. In summer he would often have to seek shelter under some friendly tree to escape from the heat of the sun. Probably when he reached the Pacific coast he would have to use an umbrella because there the rainfall is particularly heavy. For the most part, he would make his trip under bright blue skies, for Canada is a land of sunshine.

A glance at the ordinary map of Canada shows us that the country is divided into nine provinces and two territories. The provinces are Nova Scotia, New Brunswick, Prince Edward Island, Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia. The territories are the Yukon and Northwest Territories. Those divisions were made by men for the purposes of government. Every country must be governed so that people can have police protection, good roads, waterworks, and so forth. People pay taxes for such things. Smaller divisions aid in tax-collecting.

But really to understand this great country we must forget the divisions made by man and look at the land surface as Nature formed it through

long ages. Then we shall understand why the large cities sprang up where they did. We shall know why one part of the country is suited for manufacturing, while another is better for farming or mining. We shall see why some rivers empty into the Arctic Ocean, others into the Pacific, and still others into the Atlantic.

People who have studied the making of the earth say that it took millions of years to produce the land surface as it is today. For hundreds of thousands of years parts of the world would be under the sea. Then some movement in the interior of the earth would lift those parts up above the sea-level. At another period in the history of our globe great blankets of ice covered whole continents. When the ice disappeared, it left traces behind, for in some places it had scraped high mountains down into hills or even flat plains.

All these changes altered the surface of Canada. That is why we have snow-topped mountains in one part of the country and level plains in another. But we shall understand this better as we take a journey from coast to coast and from the United States boundary line to the Arctic Ocean.

THE EASTERN NATURAL DIVISION OF CANADA

Let us suppose that we are starting from Halifax in Nova Scotia. As we said before, Nature did not divide the land into provinces. She made much bigger divisions. Nova Scotia, New Brunswick, Prince Edward Island and part of the province of Quebec come into a section which is called the Appalachian Region. If we draw a line from Lake Champlain in the province of Quebec to the city of Quebec, all the land in Canada east of that line and south of the St. Lawrence River is in the Appalachian Region. The name Appalachian was given because the Appalachian mountain range extends from Canada through eastern United States almost to the Gulf of Mexico. We can guess, then, that the Appalachian Region of Canada will be hilly.

Once upon a time these hills were high and rugged mountains, but rain, snow and glaciers wore them down. If we could rise in the air above Halifax, we should see that the whole Appalachian Region slopes upward from the east coast of Nova Scotia to the hills in the province of Quebec. This slope is not a smooth one because in Nova Scotia and New Brunswick one or two lines of hills stick their peaks up quite sharply above the usual level. Valleys also make depressions, or an arm of the sea enters in where the Atlantic has eaten away the softer rocks. Indeed the land between Prince Edward Island and the mainland was entirely washed away, while the Bay of Fundy almost separates Nova Scotia from New Brunswick.

HOW THE EXCELLENT HARBORS WERE FORMED

Nova Scotia has parallel ridges of wooded hills, and between the ridges are fertile valleys which support rich farms. The sea has played some queer tricks in biting pieces right out of the land, but it did a good turn when it provided the splendid harbor for Halifax. This harbor and the St. John harbor on the Bay of Fundy are free from ice all the year round and are the Atlantic winter ports for ships arriving in Canada. A curious and very beautiful example of the action of the sea may be seen on Cape Breton Island, the northeastern part of Nova Scotia. There the Atlantic has scooped out the centre of the island and formed the Bras d'Or Lake which, of course, is salt water.

The arm of the sea, the Bay of Fundy, which almost separates the two provinces of Nova Scotia and New Brunswick, is noted for its strange high tides. Near the sea this tide sometimes rises fifty feet. On the southern edge of New Brunswick is a range of hills which protects the rest of the province against the incutting of the bay. These are somewhat higher than the hills in Nova Scotia, but they quickly sink into a plateau which extends to the Quebec boundary. This plateau is covered with forest and is well watered by many lakes and rivers. At the mouth of the St. John River, which is the largest in the province, is the city of St. John, which provides one of the winter gateways to Atlantic ships.

Prince Edward Island is the least rugged and hilly part of the Appalachian Region. But it is a rolling country, and at one time was as thickly wooded as the rest of the region. Much of the land has been cleared of trees, and it has become an island of farms.

MUCH OF THE REGION IS STILL A FOREST

When we turn to the Quebec end of the region we find that the hills are much

THE DOMINION OF CANADA

BRITAIN'S VAST DOMINION IN NORTH AMERICA, COVERING AN AREA OF MORE THAN THREE AND THREE-QUARTER MILLION SQUARE MILES

higher. The Shick Shock Mountains of the Gaspé peninsula are often over 2,000 feet in height. They run southward into the Notre Dame Mountains, which spread over the Eastern Townships of Quebec. Where the land has been cleared of trees it is excellent for farming and cattle-raising.

All of the Appalachian Region is well watered, both by lakes and rivers. Many of the rivers are swift and can produce water power to supply electricity. But little of this power is used, because the population is small in comparison with the size of the region. In Nova Scotia, New Brunswick and Quebec, some districts are so untouched that moose, deer and bears roam the woods and offer good sport for hunters. There is a plentiful supply of fresh-water fish in the streams and lakes, but it is at sea-fishing that many of the men of coast towns and villages earn their living. With the thick covering of forests, lumbering is an important industry of this region.

Many of the minerals found in the eastern states of the United States are found also in the Appalachian Region in Canada. Coal, gypsum, iron and gold are mined in Nova Scotia. Natural gas, iron, antimony and manganese are found in New Brunswick. Iron, copper and asbestos are mined in Quebec. The asbestos mines in Quebec are the best yet discovered throughout the world. Because of the nearness of the Atlantic the climate of this part of Canada is milder than sections altogether inland. But there is always plenty of snow in winter. The rainfall is heavier than in any other part of Canada except the Pacific coast.

THE BOUNDARIES OF THE ST. LAWRENCE LOWLANDS

Continuing our journey westward, we come to the second natural division of Canada. Again let us look at the map while we trace a line around this section, which is called the St. Lawrence Lowlands. Starting at Lake Champlain, we take our line up to the city of Quebec, then west to a spot just beyond Ottawa in the province of Ontario. From Ottawa our line goes south to Kingston, and then straight west to Georgian Bay. The southern boundary line is the boundary line between Canada and the United States. Now that we have an idea of what makes up the St. Lawrence Lowlands, it is easy to understand the name. It is the land around the St. Lawrence River and it is low, flat country.

In the province of Quebec the Lowlands have eight peaks which stand up from the plain. These are called the Monteregian Hills, and are the worn remains of ancient, extinct volcanoes. The best known of these is Mount Royal, just behind Montreal. As we cross into the province of Ontario the Lowlands are still flat, but they are higher above sea-level. West of Niagara Falls they are still higher. Long, long ago, when glaciers covered the land and the mouth of the St. Lawrence River was blocked up by ice, this part of the Lowlands was under the waters of two lakes, which the geologists have named Lake Warren and Lake Iroquois. The mud which was left on the floors of these old lakes has provided rich soil for farming. Many rivers flow through this division of Canada into the St. Lawrence, so the land is well watered. Before the white man came, dense forests grew on the banks of the St. Lawrence. But, as the river was the highway for trade, people settled on its shores and cleared the land for farms. The climate in Ontario is milder than that in Quebec. The Great Lakes temper the cold in winter and moderate the heat in summer.

THE MANY SOURCES OF ELECTRIC POWER IN THE REGION

The St. Lawrence Lowlands is a natural farming district, but it has become a manufacturing district, too. This has happened because ocean steamers can come up the St. Lawrence River to Montreal. From Montreal smaller steamers can carry goods to the Great Lakes. Another advantage that has helped make this division of the country important is the water power easily obtained. So much electricity is used nowadays in manufacturing that it is important to have a cheap supply. We know that electricity can be obtained where there are falls or rapids in a river, because engineers can put a dam across the rushing water and use it to produce electricity. By our maps we can see that the St. Lawrence River gets its water from the Great Lakes. If we measure the height of Lake Superior we find that it is 602 feet above sea-level. That means that between Lake Superior and the mouth of the St. Lawrence the water must drop 602 feet. It does not do that all at once.

Photo, Canadian National Railways.

This view of Little Fox River, a typical fishing village on the Gaspé coast, shows clearly the rolling character of the Appalachian Region. The hills are tree-clad, but the soil is not suitable for farming. Numerous bays and inlets are found on the entire coast-line of this division of Canada.

Photo, Canadian Pacific Railway.

This is one of the most beautiful scenes in Nova Scotia. Artists come from far and near to paint the valley of Bear River. The gentle hills and verdant valleys of this part of the Appalachian Region seem to have mellowed. Fruitful farms spread before the eye and the country seems prosperous.

There are small drops between Lake Superior and Lake Huron, and again between Lake Huron and Lake Erie. But between Lake Erie and Lake Ontario comes the wonderful drop from 572 to 246 feet. We call that drop the Niagara Falls. Between the east end of Lake Ontario and Montreal are a number of very swift rapids. Rapids mean a drop in the river, but they are not so steep as falls. The Longue Sault, the Cedars, the Cascades and the Lachine Rapids are used to give electricity that not only lights homes and shops, but gives power to turn thousands of factory wheels. The two biggest cities, Montreal and Toronto, are in the St. Lawrence Lowlands, and it is the business centre of Canada.

THE LAURENTIAN PLATEAU IS THE THIRD DIVISION

Now we look northward on our map. The Laurentian Plateau, or the Canadian Shield, as it is called sometimes, takes in more than half of the land surface in Canada. Its boundaries are easy to follow. On the east and southeast we find the Atlantic Ocean and the St. Lawrence River. To the south is the division we have just read about—the St. Lawrence Lowlands—also Lake Huron and Lake Superior. A line drawn through the Lake of the Woods, Lake Winnipeg, Great Slave Lake and Great Bear Lake to the Arctic Ocean, gives us the western boundary. The icy waters that wash the northern edge of the American continent form the northern boundary.

It is not hard for us to guess how this division came to be called the Canadian Shield. We can see at once that in shape it looks like a huge V or shield. There are 2,000,000 square miles of land in this Shield. A great body of salt water, Hudson Bay, comes in from the north and splits the land into the two arms of the V.

Before the Ice Age this part of Canada was covered with great mountain ranges. But the slow-moving glaciers were so heavy that they simply ironed the great mountains away, until to-day the whole Shield is made up of low, rounded hills. Not only did the glaciers smooth down the mountains, but in many places they scooped the soil out of the valleys, so that most of the land is not good for farming. Fortunately trees will grow where the soil is not sufficient for agriculture, and much of the land surface became covered with evergreen forests. In the southern part of the Shield the trees were large, but toward the north they became smaller. Around Churchill, on the west side of Hudson Bay, and farther south on the east side, the forests thinned out and disappeared. North of a line drawn through these points we have the "barren lands," which possess only small shrubs and grass. At present the only use for the barren lands is to give pasture to the herds of caribou and musk-ox.

THE MOUNTAINS AND HILLS OF THE SHIELD

Except in the northeast, few of the mountains rise above 2,000 feet. But along the Labrador coast is a range of mountains, the Torngats, which are about 6,000 feet above the level of the sea. Around Hudson Bay we find a belt of land which is only 500 feet above sea-level and is fairly flat. In Ontario, along the line of the Canadian National Railway, is another flat section. This is called the Clay Belt, and it is thought that it was once the bed of a great lake.

But the most interesting and most important part of the Shield is a hump of hills which is called the "height of land." This is a range of hills about 2,000 feet high and usually hundreds of miles wide. It runs parallel to the outside edges of the Shield from the Atlantic in the east almost to the Arctic in the northwest. It is important because it divides the direction in which the rivers flow. North of the "height of land," the streams flow into Hudson Bay. South of this hump of hills, the rivers empty into the St. Lawrence River or the Great Lakes. Not only has the Canadian Shield hundreds of rivers, but it has countless lakes as well. Looking at the map, we can see that the Shield is a network of rivers and lakes. On many of the northern rivers canoes only can be used, because they are so rocky, and many of them have not been explored. But there is untold water power which some day perhaps will be used to produce electricity.

TIMBER, FURS AND MINERALS IN ABUNDANCE

Because the Canadian Shield is not an agricultural district fewer people live there than in other parts of the Dominion. But, nevertheless, it is a very rich tract of country. Above the ground there are the evergreen forests which provide timber for building and pulpwood for paper-making. In the forests beyond the point

Photo, Canadian National Railways.

The St. Lawrence Lowlands are, as a rule, as flat as the palm of one's hand. Our photograph shows the fields of the farming district south of Montreal. At one time thick forests covered this fertile area, but the early pioneers cleared the land. Rivers and lakes provide an abundant water supply.

Photo, Canadian Pacific Railway.

Countless lakes and rivers form a network of waterways throughout the Laurentian Plateau. The southern country in this natural division of Canada is a succession of hills clothed in evergreen forests. Northward the trees dwindle in size until they die out. This view takes in St. Jovite on Lac Ouimet.

where the lumbermen cut down the trees are fur-bearing animals. Trappers, Indian and white, make a living by bringing in the skins to the big fur companies which have posts almost to the Arctic Ocean. But it is the wealth underground —the minerals—that promises to bring prosperity and riches to this part of Canada in the future. At present the ground is barely scratched, but famous discoveries have been made. The nickel-copper mines at Sudbury are the best of their kind in the world. In the Cobalt district, a hundred miles away, are rich and easily worked silver-mines. Gold, lead, zinc, iron, graphite and other minerals are also found. But railways only touch the edge of the Shield, so many of the mines discovered are too far off to be worked. But some day, when Canada has a greater population, the rivers of the Shield will be used to produce electricity to give power to work new mines.

One drawback to progress is the climate. The winters are long and severe, and snow covers the ground for the greater part of the year. But when the world needs minerals men will overcome the cold and work the mines. In the barren lands there is nothing to attract Indians, much less white men. But practically no prospecting for minerals has been done there. so we do not know what wealth they possess.

THE GREAT INTERIOR CONTINENTAL PLAIN

The fourth division of Canada has a quite different surface from the other three we have read about. It is part of the Interior Continental Plain. The name tells us what it is—it is the plain in the interior of the continent of North America. In Canada it stretches from the Canadian Shield to the foothills of the Rocky Mountains and from the United States border to the mouth of the Mackenzie River. Looking down on this plain, we can imagine that it is a great flat field. In shape it is like an irregular triangle with a base 800 miles long at the international boundary line. It takes in part of Manitoba, Saskatchewan, Alberta and the Northwest Territories. North of the Saskatchewan River, the plain is fairly level rolling country, but it does have trees. South of the Saskatchewan, there are practically no trees except some that the farmers have planted.

If we start from Winnipeg, we seem to be looking at land that is as flat as the palm of a person's hand. And probably it is as flat as land can be found anywhere. That is not surprising, as the geologists tell us that all this flat land around the Winnipeg lakes and the Red River valley was once the bed of a tremendous ancient lake—Lake Agassiz. As we near the western border of the province of Manitoba we reach a sharp slope which once marked the bank of that old lake. All the plain east of the sharp slope we call the first prairie level. The first prairie level is only 800 feet above the sea on an average.

THE HIGHER LEVELS OF THE PRAIRIE REGION

The second prairie level is much higher above sea-level, with an average of 1,600 feet. It is rolling land with wide river valleys and very low hills. If we look at a map of the Canadian prairies, we see a line of hills crossing the boundary line about the middle of Saskatchewan. This line is the Missouri Coteau, and it stretches to the northwest and makes a division between the second and third prairie levels.

The third prairie level is about 2,000 feet high along its eastern border and slopes upward to 4,000 feet as it reaches the Rocky Mountains. The surface of this level is much more irregular than that of the first two. It has table-lands, like the Cypress Hills and Wood Mountain, and it is much more rolling than the second level. If we were giants, we could imagine the great plain to be made of three steps rising from east to west. As water does not flow uphill, the rivers in the Continental Plain pour eastward or northward down the slope, and empty into Hudson Bay or into the Arctic Ocean.

THE WONDERFUL WHEAT GROWN ON THE PLAIN

The northern part is better watered than is the southern part. But unless the summer is unusually dry, the southern crops do not suffer. The Interior Continental Plain has a cold winter, but it is famous for the wonderful wheat it produces. Settlers have come to Canada from all parts of the world and have taken up free land on the prairies. They plow the land, root out the grass known as "prairie wool," and grow wheat unsurpassed in all the world. There used to be great cattle ranches on the prairie,

THE GREAT NATURAL WEALTH OF CANADA

Photo, Canadian National Railways.

THE CREIGHTON NICKEL-MINES AT SUDBURY, ONTARIO

A SHEEP RANCH ON THE GREAT PRAIRIES OF WESTERN CANADA

LOADING SALMON IN A CANNERY ON THE BRITISH COLUMBIA COAST

Canada is rich in minerals, in forests of timber, in land for herds of cattle and flocks of sheep and crops of all sorts; and her rivers teem with fish. These three scenes show something of Canada's wealth. At the top is a picture of the Creighton nickel-mines at Sudbury, Ontario. Next we have a view of a sheep farm which a few years ago was prairie. The third picture shows the salmon-fishing industry.

especially on the third level; but the land has become of more value as grain land, and nearly all the big ranches have disappeared.

The Interior Continental Plain is of utmost importance as a grain-growing country, but it has other sources of wealth, too. Natural gas is found in Alberta. Oil has been discovered in Alberta and in the Mackenzie district. Soft coal is to be had in abundance in Saskatchewan and Alberta. Gypsum is quarried in Manitoba.

THE LONG MOUNTAIN BACKBONE OF NORTH AMERICA

Now we come to the fifth division, the mountainous region. This is called the Western Cordillera. Cordillera is a Spanish word which means "range of mountains." We use the Spanish word because the western mountains in Canada are part of the long rocky backbone of the two continents of North and South America. The Spaniards, who were the first comers, used the word cordillera to mean this backbone, and we borrowed it from them. In Canada this region extends from the United States boundary to Alaska, and it has an average width of 400 miles. It covers part of western Alberta, all British Columbia, all the Yukon territory and part of the Northwest Territories. By looking at our maps we can see that in size it comes next to the huge Canadian Shield. The Pacific Ocean is its western boundary.

As we look westward from the prairie we see the land rising gradually in little hills. These are called the foothills. Then we see very lofty jagged peaks which seem to touch the sky. Often these peaks are entirely hidden in the clouds. These are the real Rocky Mountains. It would be easy to believe that some giants had piled here all the rocks in the world. And on top of the huge piles is a blanket of snow. Thousands of glaciers, some large and some small, are still to be found in the Rockies. Just west of this range we find a chain of valleys. This is known as the Rocky Mountain Trench. In this trench the Columbia and Fraser rivers rise and flow south until they find a passage through the mountains farther west. Then they empty into the Pacific Ocean. To the north in this valley rise the Peace River, which empties into Lake Athabasca, and the Liard River, which is a tributary of the Mackenzie River.

THE DIFFERENT CLIMATES OF THE CORDILLERA

Between the Rockies and the Coast Range, which runs along the Pacific border, we find a number of smaller ranges, such as the Selkirks, the Gold Range, the Caribou Range and the Cassfor Mountains. In the valleys between them we find many rushing rivers and beautiful lakes. Some of the valleys have rich farming and pasture lands. Near the United States boundary line and just east of the Coast Range the mountains have spread out and there is a plateau where most delicious fruit is raised.

There was once another range of mountains still farther west than the Coast Range. But if we look at our maps again, we shall find that all that remains of those mighty mountains are the hilly islands. Of these Vancouver Island and the Queen Charlotte group are the biggest.

THE MAGNIFICENT TREES OF THE SLOPES

On the slopes of all the mountains are forests which thin out as they reach up toward the snow-line. But the mountains nearer the coast are specially blessed. There we find the giant cedar and the Douglas fir, which grow to 150 feet in height and are sometimes more than ten feet through the lower trunk.

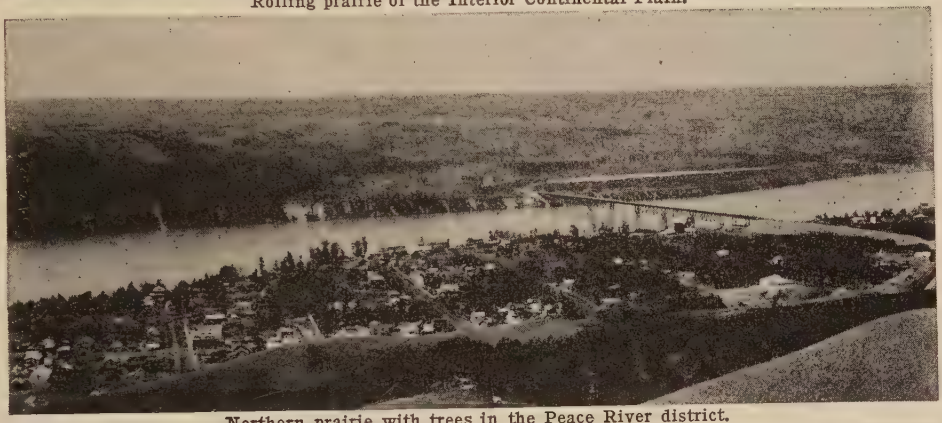
When the valleys are cleared of trees, the soil is fertile and is excellent for farming, small fruit-growing and cattle-raising. The many rivers which pour into the Pacific are noted for their salmon and other fish. Lumbering, farming and fishing are valuable industries, but they are not so important as mining. This region is so vast that we may say it has hardly been touched. Yet already millions of dollars of gold have been taken out of the gold-mines. The coal-mines of the Cordilleras are thought to be the best in the Dominion. Copper, lead and zinc are also mined in great quantities.

THE ISLANDS OF THE ARCTIC ARCHIPELAGO

The Arctic Archipelago is the sixth and last of the natural divisions of the Dominion of Canada. It is made up of all the islands to the north of the North American continent. There are three very large islands, Baffin, Ellesmere and Victoria, and hundreds of smaller ones. We know that some of these islands are mountainous. But they are all north of the Arctic Circle and so difficult to get at that

PLAIN AND VALLEY OF WESTERN CANADA

Rolling prairie of the Interior Continental Plain.



Northern prairie with trees in the Peace River district.

Fernie, British Columbia, lies in one of the wide valleys of the Western Cordillera. Between the magnificent ranges are broad level tracts of land where flourishing towns and industries have grown up. In southern British Columbia some of the valleys are noted for their fruit-raising.

Photos, Canadian National Railways.

Peak, forest and lake—Lake O'Hara in the Canadian Rockies is a jewel in a mighty setting.

really we know very little about them. Explorers have reported the finding of gold, copper, mica and coal on some of the islands. But their reports are so scanty that no one can say how valuable the mines would be.

When we have finished reading this description of Canada, the thought must come to us that the country has been richly blessed. It has beauty and grandeur of scenery. It has a healthy climate. It has untold wealth in its soil and rocks. It has water power which can be harnessed to produce an enormous quantity of electricity. For its great area the country has a population of 9,000,000 only. It has room for ten times that number, and the time will come when all those natural resources, as we call those blessings, will be used for the benefit of the increased number of Canadian citizens and the world in general.

In this article we have not given the scientific names of the rocks which make up the land surface of the country. But girls and boys who want to know such names will find a great deal of information about the rocks in the articles on geology.

THE NEXT STORY OF CANADA IS ON ANOTHER PAGE.

Klemtoo Pass, British Columbia. The fiord-like coast of this mountainous province provides good harbors as well as scenic beauty.

Photos, Canadian Pacific Railway.

PLANT LIFE

WHAT THIS STORY TELLS US

THE oldest living things on earth are plants. They cover the earth with beauty like a truly magic carpet, and they are the very foundations of our lives. We could not live without them; but for the plant kingdom, spread over the whole surface of the earth and along the surface and the bottom of the sea, the animal kingdom must perish. The whole world depends for its food upon plants, and the whole world depends, therefore, upon a secret that a plant has which no man knows; for a plant knows how to take its food from air and water. It takes its supplies as it stands there rooted in the soil, nourishing itself in some mysterious way from the atmosphere direct. As we stand looking at it, a plant is making its own food; no man knows how. Here we shall read of the wonder that astonishes all who think of it—the life of the kingdom of plants.

HOW LIFE GOES ROUND AND ROUND

FOR a very long time there were no living creatures at all upon this earth of ours. That was many years ago, when the earth was too hot to be the home of life. But in the course of time the earth cooled, the depressions came to be filled with water, and there was a heavy atmosphere of gas. When the earth was ready for life the first living creatures made their appearance, to be followed by all the wonderful life we see around us.

What the first living things were like we do not know—almost all beginnings are very misty—but it is thought that they were microscopically small, as small as the microbes which cause decay and disease. If this is true, then they could not have been seen if there had been anyone to see them, any more than we can see the bacteria which are everywhere around us to-day. You know that these things exist even if you do not see them.

Another thing that is almost certain is that the first living creatures were neither decided plants nor decided animals. They were, so to speak, hesitating between these two very different lines of life. They were nearer plants in this way—that they were able to feed at a low level on water and carbonic-acid gas (carbon dioxid) and salts in the water; they were able in some measure to use the energy of the sunshine to help them to build up carbon compounds from simple materials.

It is not always easy to say whether some of these tiny creatures are plants or animals. Everyone of us feels that there is a great difference between a chestnut tree and the squirrel upon one of its branches; but it is not so easy to distinguish between a mushroom and a sponge. For a long time the old naturalists thought that such things as corals and sponges were plants growing in the sea. Still more difficult is it to be sure whether a living creature with a single cell is a plant or an animal. There are creatures, sometimes called slime-molds, which the botanists and the zoölogists both claim, and no one can decide.

Long, long ago, then, some simple, single-celled creatures manufactured the green coloring matter called chlorophyl. They began to build up quantities of sugar, starch and other carbon compounds. These were the first plants, and they probably lived freely in the sea. The secret of their success was the ability to feed at a low chemical level and to use the power of the sunlight in their chemical operations of building up. Their success meant much for future history, for they made carbon compounds sufficient to feed not only themselves but the animal world which feeds on them. Happily for us, plants are like misers, accumulating much more than they need; animals

are spendthrifts, often living close up to their income.

THE SOMETHING OF THE ANIMAL THAT IS OFTEN FOUND IN THE PLANT

It is not surprising that something of the animal may often be detected in the plant, and something of the plant in the animal. Let us take a few examples. The sundew and the Venus's flytrap and other "insect-eating plants" have turned the tables on animals; they depend in part on insects for their food, and catch them very effectively. Many leaves rise and fall, many flowers open and close, with the growing and waning light of day.

Young shoots bend and bow to the different points of the compass; the tendril of the pea is extraordinarily sensitive to the touch of a twig, and its tip moves around in little paths *as if it were searching.*

All plants are sensitive in some measure, and Sir J. C. Bose, the great botanist of India, has proved that a tree may answer back to a passing cloud. Many plants, if not all, have some capacity for movement, and there is a telegraph-plant in the Ganges basin—called Desmodium—whose leaves are always moving a little. When the Venus's flytrap in the Carolina swamp shuts the two halves of its rat-trap-like leaf and catches a fly, there is an electrical change similar to that which occurs when we contract our muscles in shutting our hands.

THE SOMETHING OF THE PLANT THAT IS OFTEN FOUND IN THE ANIMAL

Many animals, like sponges, zoöphytes and corals, exist in a plant-like sluggishness. Except when they are very young, they are fixed. Many of them are much given to branching, often in a very tree-like way. In the sea-squirts there is abundant cellulose in the enveloping coat —a characteristic vegetable substance in the most sluggish part of a very sluggish animal.

A number of sluggish animals resemble plants in accumulating quantities of stored material, which may be utilized in hard times or serve as a legacy for the young ones. Not a few animals have a very plant-like power of partially dying down when outside conditions are unfriendly, and some types form resting germs which last through the hard times of winter, as the seeds of many plants do.

So far as complexity of structure and life-history go, the whole kingdom of many-celled plants is simple compared with the animals. They are all within a comparatively narrow range. But what diversity there is between toadstool and oak tree, between the lichen on the hill-top and the fields of golden wheat, between the beautifully colored seaweeds and the flowers of the meadow! Or, if we take a single class, like that of ferns, what a multitude of kinds there are, each itself and no other!

And we get the same impression of endless form-changes when we study a single order of flowering plants—say, the Rose order. All the members have a great deal in common; they are near relatives.

Yet how different at first sight seem such plants as the rose, strawberry, apple, cherry and meadow-sweet! Who would think at first sight that the columbine, monks-hood and buttercup belong to the same order?

And, besides variety of form, there is variety of habitat. Where is there any plantless place, except in the darkness of the deep sea? There may be "red snow," due to a very simple plant, on a floating iceberg; there are some simple plants in hot springs; there are Alpines above the snow-line on the mountains; there are molds glistening on the underground passages in mines; and doctors sometimes speak of the "flora" of man's food-canal!

Another fact so plain that we hardly think about it is the almost universal beauty in the plant world. The exceptions are certain cultivated plants, like cauliflower and cabbage, which have lost most of the beauty of their wild ancestors. Think of the harebells swinging by the wayside, the wood-hyacinths, which the poet speaks of as the heavens upbreaking through the earth, the laburnum's dropping wells of fire, the daffodils dancing by the lakeside, Wordsworth's "jocund company." No doubt there is easy beauty and difficult beauty, but the big fact is *beauty everywhere.*

BEAUTY CROWDS UPON US ALL OUR LIFE IN NATURE'S WIDE KINGDOMS

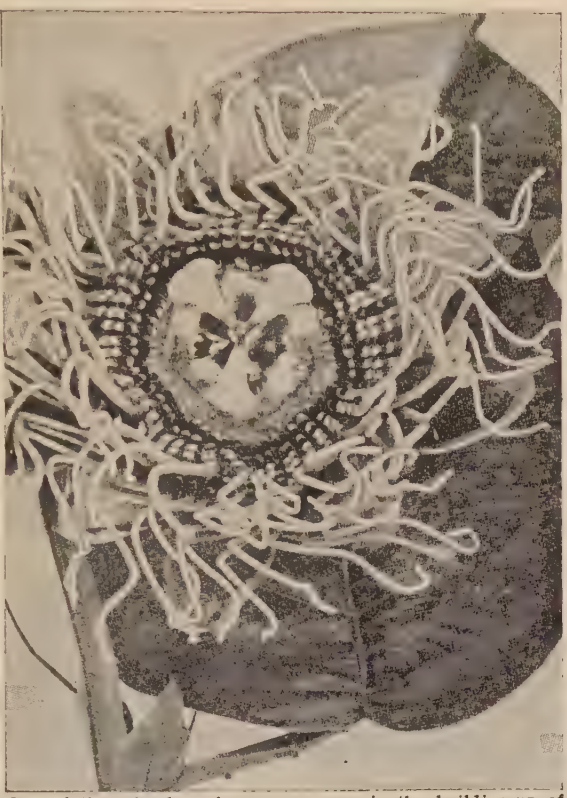
The old idea that beauty is exceptional, and to be looked for especially in such plants as orchids, has almost disappeared. Many orchids are, indeed, beautiful, and often strangely like butterflies, but one cannot say that they greatly excel some of our common flowers—the violet, the butterwort, the bog-bean, the bladderwort, the grass of Parnassus, the bog-pimpernel

and the daisy. The fact is that beauty crowds us all our life if we keep in touch with wild flowers; and this is a fact not less important than the statement that the central secret of the green leaf is being a sunshine-trap.

We have not learned much botany unless we have come to feel the beauty of common plants. The poet Keats said that throughout his life nothing moved him more than the opening flowers. There is something wrong with us and with our science if we do not feel the wonder of the crocus breaking through the sod. But it is worth our while, also, to discover thrills, to follow the stream up the gorge till we find the Royal Fern, glistening with spray beside a waterfall:

Plant lovelier in its own recess
Than Grecian maid seen at earliest dawn
Tending her font, or lady of the lake
Sole sitting by the shores of old romance.

We are accustomed to think of strength in connection with animals and machines that move quickly about and do things and withstand assaults. The elephant, the railway-engine, the lighthouse, show strength. On the other hand, we think of the tender plant, the bruised flax, the short-lived grass, the poppy which is broken by being plucked. As everyone knows, many of our gay garden flowers are annuals, lasting only for the summer.



One of the miracles of every summer is the building-up of such a flower as this from a tiny seed.

The glory of the flowers of the field.

But this is only one side of the picture. The grass withereth and the flower fadeth; but, after all, the grass is one of the most successful of all living things. It has covered the earth like a garment.

This power of spreading and multiplying is all very well when the plant is on man's side, as most grasses are; but when it is an injurious plant that spreads, like thistle in this country or prickly-pear in India, then we see the menace there may be in the strength of plants.

We are often impressed by the weight-lifting feats of the strong

man at the show. Have we done justice to the quiet strength of the forest trees, which are continually sustaining enormous weights against gravity, every year adding to their burden and lifting it higher? We know the explosive power of dynamite, but it is very interesting to see the roots of a tree spreading within a cleft in the rock and ending by rending it asunder. We know of the great transformations of energy which go on in chemical and engineering works, but we must do justice to the intensity of the operations that continue unceasingly through the summer day in the chemical and physical laboratory of every green leaf; and all without a sound!

NO PLANT IN THE WORLD LIVES OR DIES TO ITSELF

What strength of a sort there is in the way that microbes multiply, killing a king in a few hours! If one bacillus of the plague gets entrance into man through the bite of a rat-flea it may be represented by a million the next day. What strength of renewal there is in many plants; the hawthorn is all the more vigorous because of the hedgeman's savage pruning. Then there is the strength of longevity, for the oldest living creatures in the world are some of the big trees of California.

One of our poets is responsible for the magnificent exaggeration :

> Thou canst not stir a flower
> Without troubling of a star.

It is but a striking way of saying that no plant lives or dies to itself. Every one is the intersection of numerous threads in the web of life.

First, there is the work of plants in the *circulation of matter*. As we have seen, green plants feed on air, water and salts; they use the carbon of carbon dioxid as the basis for manufacturing the essentials of life known as starch, sugar, fats and proteins. Some animal eats the plant, or part of the plant, and another incarnation begins. The material obtained from the plant—the nectar which the bee changes into honey, the nut which the monkey cracks—becomes part and parcel of the animal's body; it is incorporated in some measure into the animal's living matter. As the animal lives, it gives off carbon dioxid; and this, regaining the atmosphere, may be absorbed by a green plant.

Other forms of waste from the animal pass into the soil and may help to form salts which the roots of plants may absorb. Some may pass as ammonia into the air, and this may be washed down by rain into the soil, to be again recaptured by the roots of plants. Or, when the animal dies and sinks to the ground, bacteria begin to work on the dead body, and it rots. Its complex substances are broken down into simple substances, such as carbon dioxid, water, ammonia and some salts. Out of a dead bird on the ground the bacteria make materials which plants can utilize. Bacteria act as middlemen between the dead animal and the living plant. They make the materials of the dead body fit to enter again into the cycle of life; and so the world goes round.

THE SMALL SPECKS OF LIFE ON WHICH THE CREATURES OF THE SEA LIVE

If we pay an early-morning visit to a great fishing-port, we see what look like miles of fishes laid out for sale. We get a glimpse of the harvest of the sea, and the question arises in our minds, How is man able to take so much out of the sea, year after year, when he puts so little in? If he did this on the farm, there would soon be exhaustion of the soil, and he prevents this on land by putting in manure. But what happens in the sea?

The answer is partly to be found in the vegetable sea-dust which is wafted outward and downward from the shallow water, where seaweeds and sea-grasses flourish abundantly. Minute particles, worn off by the breakers or nibbled at by animals, are washed down the slope and form the food supply of fishes or animals, worms and molluscs on which fishes feed. It takes ten pounds of this vegetable sea-dust to make a pound of worms; it takes ten pounds of worms to make a pound of whelk; and it takes ten pounds of whelks to make a pound of rock-cod!

THE WONDERFUL CYCLE OF LIFE BY WHICH THE WORLD GOES ROUND

But the other half of the answer is to be found in what Sir John Murray called the floating sea-meadows of the open sea. Countless millions of diatoms and other minute algæ form a sort of living sea-soup at, or near, the surface of open waters. These minute organisms depend on the air and the sea-water with its salts; in the sunshine they go on with their work of building up life from light, like the leaves of the forest; they and some minute green animals form the fundamental food supply of tiny shellfish; and these, again, are devoured by fishes.

The earth is run on a plan of successive incarnations something like this :

Air, water and salts are absorbed by green plants in sunlight.

Nutritive carbon compounds are built up out of these, and are eaten by animals.

The animals die, and their dead bodies are destroyed by bacteria.

THE WONDERFUL CYCLE OF LIFE THAT NEVER ENDS AND NEVER FAILS

Life works in a never-ending cycle. Water, gases and salts are absorbed by plants as food. The plants are eaten by animals, the animals die, and bacteria destroy their bodies. From these bodies rise new gases, water and salts. These are absorbed by plants again, and the cycle of life begins afresh.

From the decay of these bodies gases, water and salts are formed.

These are absorbed by green plants again, and the cycle of life begins afresh.

A great transformation of energy is always going on in plants. The plant is a laboratory of complex chemical substances, and each has its own chemical routine, as every chemical factory has. But this work of building-up could not keep going without help from outside, and it is the green plant's special secret to obtain this from the orange-red rays of the sunlight. The energy of the sunlight is used by the plant to help it in its manufacture of carbon compounds, which have chemical energy just as gunpowder has.

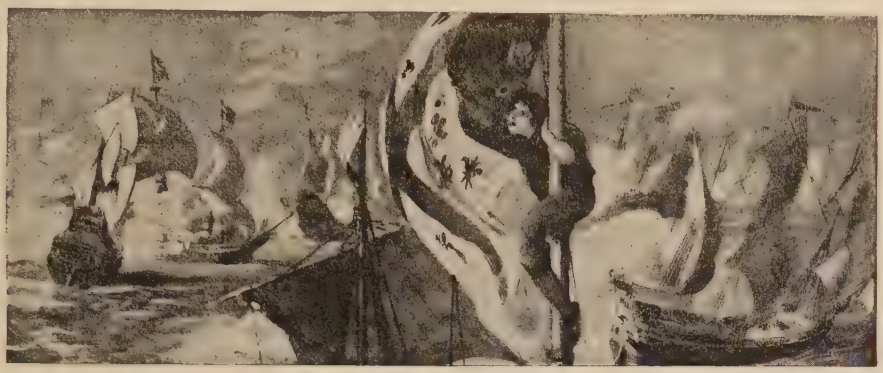
Thus there is a continual changing of kinetic energy into potential energy. We see the same thing when the kinetic energy of a rush of water is used by a hydraulic machine to raise a heavy weight to a height where it has energy of position, or *potential energy*. But what takes place in the green leaf is a more wonderful transformation, and it is not yet fully known.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 219.

THE VENERABLE BEDE TRANSLATING THE GOSPEL INTO ENGLISH IN THE LAST HOURS OF HIS LIFE

This picture, by J. Doyle Penrose, shows us the Anglo-Saxon teacher Bede dictating the Gospel of St. John to one of his young scribes, as told on page 126.

By permission of the Autotype Co.



THE BRAVE APPRENTICE

THAT some of the greatest men have risen from the humblest circumstances is true in almost every walk of life, and certainly the navy is no exception. Somewhere about the year 1680 a small boy sat working upon a tailor's bench at Bonchurch, in the Isle of Wight. His master being out of the way for the time, the boy had dropped his needle and was gazing out to sea, wishing he was anywhere but in that shop. He was a pauper orphan, and had been apprenticed by the parish authorities to a tailor.

As he was dreamily gazing out to sea a squadron of British warships came into sight round a bend of the coast. Without a moment's hesitation the boy threw down his work, and, running out of the shop, rushed to the beach, where he jumped into a boat, and rowed as hard as he could to the admiral's ship.

The conditions of life on the warships were then very hard indeed, and recruits were wanted badly, for men were not anxious to join the navy; so when the little lad offered his services they were readily accepted.

It was not long before he saw active service, for on the very next morning the British ships fell in with a French squadron, and fighting began at once. The boy did his duty well, running hither and thither as he was bidden, and taking a keen interest in the exciting events around him. At last, when the fighting had been going on for some time, and there seemed no sign of a definite result, the boy asked a sailor: "How shall we know when the enemy has given in to us?"

"Oh," replied the man, pointing to the flag flying at the masthead of the French admiral's ship, "as soon as that flag is hauled down the enemy will have given in, and victory will be ours."

"Is that all?" said the boy, and hurried away.

In those days vessels did not fight as they do now, with miles of sea between them, and sometimes out of sight of one another. They ran up side by side, and the crew of each tried to board the other. The tailor's boy sprang upon the deck of the French admiral's ship, which was alongside his own, and, unnoticed in the excitement, nimbly climbed up a rope-ladder, and eagerly seized the French admiral's flag. Then, wrapping it round his body, he descended with it to the deck, still unperceived by either the French or the English sailors.

No one had seen his daring action, but presently the English sailors noticed that the French flag was gone, and, supposing that the enemy had given in, they rushed upon the deck of the French ship with such impetuosity that the enemy was filled with consternation and dismay. The French gunners fled from their guns, and within a moment or two the ship was actu-

ally in the possession of the English. Just as victory was assured, the apprentice sprang forward and showed the captured flag to his comrades, who received it with the greatest astonishment.

The news soon spread, and the boy was led with his prize into the presence of the admiral, who praised his bravery and enterprise, and promoted him to the rank of midshipman on the spot. That a lad who could do such an action as this should rise to distinction in the Navy is not surprising.

The courageous young midshipman was promoted again and again, until he reached almost the highest rank in the British Navy, and became known in history as Admiral Hopson.

THE WOMAN WHO CLOTHED THE POOR

IT is not only great and heroic acts, which appeal to the imagination, that can be described as golden deeds. Many a quiet deed of kindness or a work of mercy done away from the public gaze, and with no thought of praise or reward, has had far-reaching effects for good, and encouraged others to emulate the worthy example set them.

A striking example of this is the case of Dorcas, or Tabitha, the Christian disciple of the early Church, whose death in the midst of works of charity and helpfulness caused great distress among the poor widows of the town of Joppa, on the coast of Palestine.

Dorcas giving garments to the poor.

We do not know when Dorcas first became a convert to Christianity, but she soon learned the true spirit of the Master, as her kindly thought for the poor proves. She is described to us by St. Luke as "full of good works and alms-deeds which she did," so that not only had she physical beauty, as the meaning of her name suggests, but she was beautiful in character and in soul.

Then, as now, the poor women of cities and towns found it difficult to obtain proper clothing for themselves and their children, and it was in order to meet this need that Dorcas gave of her time and means.

She did not simply distribute so much money, and think that thereby her duty to the poor was fulfilled, but she worked with her own hands and made garments of various kinds—coats and cloaks—which she distributed freely among the poor and needy women and children of her town. The gratitude which the people felt for her on account of her loving service is shown by the fact that at her death they all came together to mourn her loss, and to pay the last tribute to her memory.

Had there been no other result from her life and loving work than the good that came to the poor of Joppa, the name of Tabitha, or Dorcas, would have deserved to live and be handed down, as it has been. But the result was far more lasting and is seen right down the ages since those times of the early Church to the present day, and never did the bright example of Dorcas give greater inspiration than it is giving to-day to thousands of willing helpers who are trying to bring cheer to the poor.

There are few Christian churches to be found in this country, at any rate, without their Dorcas society, the aim and object of which is to do the very same work as Tabitha did nearly nineteen centuries ago. For the need for such help goes on from age to age.

It would be impossible to say how many of the naked have been clothed in all the ages, and how much joy and happiness have been brought to the poor, solely as a result of the example first set by Dorcas in the town of Joppa. Such acts as she performed are, we must all agree, golden deeds in the very highest and truest sense of the term.

HOW REGULUS WENT BACK TO DIE

FOR many years the citizens of ancient Rome had been extending their domains, until in the year 270 B.C. they ruled over almost all Italy. The Romans then crossed over to Sicily, where they came into conflict with another race of brave and adventurous conquerors called Carthaginians, who were strong upon the sea in the great vessels of their navy. The Romans as yet had no navy, so they had to build one, taking for a model a Carthaginian quinquereme (a vessel with five banks of oars), which had been wrecked on their shores.

A terrible struggle for the mastery now began. At first the Romans were victorious on land and sea. Elated with success, they decided to carry the war into Africa, and a large army under Attilius Regulus landed and swept all before them, until they came in sight of Carthage. Then, indeed, the prosperous Carthaginians roused themselves to defend their hearths and homes, and utterly vanquished the Romans. Regulus and a host of Romans were led captive into Carthage.

The war, however, went on until after five years the losses of both sides were so great that the Carthaginians hoped that peace could be made. They summoned Regulus, the captive general, before them, and said:

"We are weary of the war, and are sending an embassy to try to arrange a peace and an exchange of prisoners with your senators at Rome. Go you to Rome and prevail on them to agree. But first give us your word as a Roman that, if you fail, you will return to captivity here."

When the embassy reached the gates of Rome, Regulus stood still and cried:

"No longer am I either a citizen or a senator of this great city; neither will I enter within her walls, nor will I take my seat in her noble Senate."

On learning of this resolve, the Senate sent certain of their number to persuade Regulus to come into Rome. In the Senate he refused to give his opinions until commanded. Then the undaunted Regulus spoke out courageously:

"To no purpose is it to ransom prisoners who have ignobly yielded while they still bore weapons in their hands; let them be left to perish; let war with Carthage go on till Carthage be conquered."

His counsel prevailed, and the unsuccessful embassy returned home. With them, true to his word of honor, went back the bold, resolute patriot, though he knew that he would receive little mercy at the hands of his captors, whose hopes of peace and prosperity he had so stubbornly overthrown.

The banks of the Tiber were crowded with his fellow-countrymen as he embarked on the ship that was to bear him across the sea. It was the most glorious moment of his life as he stood on the ship bidding farewell forever to those Roman senators to whose wavering courage he had given fresh life.

And so Regulus entered Carthage once more, and his counsel was repeated to the cruel Carthaginians. They had not enough nobility of spirit, the old story tells us, to reverence a brave patriot, but instead devised horrible tortures and put him to a most cruel death.

To the Romans the name Regulus stood for the most unselfish and heroic patriotism. While leading a Roman army against Carthage, in Africa, he was taken prisoner and held captive until the Carthaginians sent him back to Rome to plead for peace between the two cities. Instead, he urged his countrymen to go on with the war; then sailed for Carthage, to suffer and to die.

THE WONDERFUL STORY OF THE VENERABLE BEDE

THE life of Bede was a beautiful one, spent far from the din of the battle-field, the bargaining of the market and the pleasures of the court.

All his days were passed, though he was the greatest scholar and teacher of Anglo-Saxon times, in the peaceful monasteries at Wearmouth and at Jarrow. There he studied, wrote, and taught the six hundred youths who gathered round him. For them he wrote textbooks covering the then known field of knowledge; for them, and for the people, he wrote a history of the English Church, telling how Christianity was brought into the country.

So earnest and noble-minded a scholar could not bear to think that the greatest book ever written should remain a sealed book to every person unable to read Latin; and he was determined, if God gave him strength to do it, to translate at least the Gospel of St. John into Anglo-Saxon, that all might hear and understand it in their own tongue. Forty-four works, mostly in Latin, he had written during his busy life of teaching; one more—the Gospel of Love—he would leave behind him. He was getting ill and feeble, but he would not leave even to the ablest pupil a work so important as the translation of the Gospel. "I will not have my boys read a lie," he declared, "nor labor fruitlessly after my death."

Day by day Bede grew weaker; but, refusing to rest, he continued cheerfully dictating to his scribe. One of his scholars, Cuthbert, wrote a description of the last hours of his revered master, and an artist has painted a beautiful picture, given on page 122, of the old man on his couch in his little cell, with a youth before him eagerly taking down his words.

In his History of the English People, the historian Green thus describes the scene:

> The dawn broke on another sleepless night, and again the old man called his scholars round him and bade them write.
>
> "There is still a chapter wanting," said the scribe as the morning drew on, "and it is hard for thee to question thyself any longer."
>
> "It is easily done," said Bede. "Take thy pen, and write quickly."
>
> Amid tears and farewells the day wore on to eventide.
>
> "There is yet one sentence unwritten, dear master," said the boy.
>
> "Write it quickly," said the dying man.
>
> "It's finished now," said the little scribe at last.
>
> "You speak truth," said the master. "All is finished now."

Placed upon the pavement, his head supported in his scholar's arms, his face turned to the spot where he was wont to pray, Bede chanted the solemn "Glory to God." As his voice reached the close, he passed quietly away.

THE LITTLE GIRL TRUSTED WITH STATE SECRETS

WE look on Oliver Cromwell as a stern character, harsh to his opponents, and forbidding in his ways. Yet he could be very gentle to a little child; and for his little granddaughter he kept a warm place in his heart. He liked to have the little girl often before him; and when she was only six years old would keep her by his knee as he sat at a Cabinet Council discussing affairs of State. Some of his ministers thought it unsafe to have even such a little girl listening while they talked about important matters concerning the country, and they let Cromwell know their fears in this matter.

"Why, there is no secret I would trust with any of you that I could not trust with that infant," was the reply of their leader.

Determining to prove to his ministers that his trust in his little granddaughter was well merited, Cromwell one day whispered to her something in confidence, saying it was a secret, and she must not tell it. He then set her grandmother and mother to try to get the secret from her.

But no threats or bribes, nor even whipping, could make the little girl disloyal to the trust the grandfather put in his Puritan grandchild. At last they gave up the attempt to get the secret from her, unable to resist longer the plea that her grandfather had trusted her with a secret and she must keep it, though she did not wish to disobey her mother.

And so Cromwell's ministers had no more fear that state secrets would be told when the loyal little girl knew them.

THE MAN WHO LOVED CHILDREN

SCHOOL is a very bright and pleasant place in these days, and boys and girls are happy when they are at school; but this was not always the case. A hundred years ago most schools were dull and gloomy, and there was no attempt to make the lessons so bright and interesting that children would look forward to them.

But here and there was a man who believed that lessons could be given in such a pleasant way that boys and girls would really love to be at school. One of these men was a Swiss named John Pestalozzi, and we all owe a great deal to him and to the way in which he gave his time and money and whole life for the great purpose he had at heart.

The old woman who lived in a shoe could hardly have had more problems to settle than this loving-hearted man, who gathered in eighty homeless children and became for them father, mother, nurse and teacher, all in one. Can you not feel how they must have loved the name of Pestalozzi?

Pestalozzi loved children, and when he saw the misery in which most of the poor boys and girls of his native land lived, he determined to do something to help them to grow up good and useful men and women. He bought a farm, built a large dwelling-house, collected fifty of the very poorest boys he could find in the roads and lanes, and took them to live with him in his house, and taught them farming.

But Pestalozzi was not a very clever business man, and at the end of five years he had spent all his own and his wife's money in helping others, and had to give up the farm. But he had done a great deal for boys and girls, for he had shown that very poor children could be educated and trained to work, and though his own school failed, industrial schools similar to his are now found in every country. But it was not only his money that Pestalozzi gave freely to help boys and girls—he gave his whole life up to them. Even when he was living quietly and apparently doing little, he was thinking hard about what could be done to help, and was writing books that explain his ideas. Then came a need for action.

In 1798 the French army acted very cruelly in the canton of Unterwalden, and many poor children lost their parents. Pestalozzi at once left his family, and, gathering eighty of the poorest children into an old convent, taught them, played with them, and did everything he could to make their lives happy.

From morning to evening he was alone with them; everything they needed was provided by his hand; every help in time of need and all their teaching came from him. "My hand lay on their hand," he tells us, "my eye rested on their eye, my tears flowed with theirs, and my laughter accompanied theirs. They were with me and I was with them. Their soup was mine, their drink was mine. I had nothing—no housekeeper, no friend, no servants around me; I had them alone. Were they well, I stood in their midst; were they ill, I was at their side. I slept in the middle of them. I was the last who went to bed at night, the first to rise in the

morning. Even in bed I prayed and taught with them until they were asleep —they wished it to be so."

The picture on page 127 shows how Pestalozzi gave himself up to the children, and how they loved him. But his life was full of disappointments, and after a year the convent was wanted by the French troops for a hospital, and the school was again broken up. Pestalozzi's life of love and self-denial was not lost. His work lives to-day in the many industrial schools for the poor, where boys and girls are taught useful trades that will fit them for the battle of life, and his labors are still bearing fruit in the better and more natural methods of teaching which all civilized lands now use.

THE BOY WHO SAVED THE BOAT

A BRITISH warship, the Seringapatam, was anchored one August afternoon off Antigua, one of the Leeward Islands of the West Indies. The weather was fine and the sea calm, and so some of the officers thought a little cruise in the pinnace to a bay two miles distant would be a nice excursion.

The plan was carried out, and a pleasant afternoon was spent. All went well on the return voyage until the wind died down and the pinnace lay becalmed upon the waters.

Then suddenly, without any warning, a hurricane burst forth with all the fury known in the West Indian Seas. A gust of wind overturned the boat, and all on board were thrown into the raging sea.

One by one they managed to swim to the gunwale of the overturned boat and cling to the sides. Their position was dangerous, as the boat was slowly drifting out to sea. Any moment the storm might break in all its severity; and worse than all else were the dreaded sharks in the waters around.

Among the officers was a brave young midshipman named Smith, who astonished his companions by declaring that he would swim ashore to get help.

"What!" they cried. "Swim two miles in this sea, with sharks all around?"

"Yes," he persisted. "There is no other chance. Will one of you go with me? I believe I can do it."

But the men kept silence.

Then Smith's fellow midshipman, Palmer, not to be outdone in bravery, and unwilling to let his friend risk his life alone, though he was not a very rapid swimmer, and far from strong, said that he would make the attempt.

So the two boys cast off their shoes, caps and jackets, and, taking leave of their companions, plunged into the sea and struck out for the shore.

At first they made good progress, but soon it was apparent to the men watching them that Smith was making greater headway than Palmer. All the time Smith was on the look-out for sharks, and at last, down in the deep clear water below him, he saw two particularly large ones swimming along.

When the boys had covered about half the distance, Palmer, whose strokes had been getting weaker, called out: "I'm done. Go on, Smith."

But Smith was not the boy to desert a plucky friend; instead, he urged him to rest an arm on his shoulder a while.

This Palmer did, and so got relief, though both boys continued to use their feet, lest the sharks should be after them. These creatures were plainly visible now, but, possibly because the boys wore dark suits and continued moving all the time, they were not attacked. The stronger boy did all he could to keep up the spirits and strength of his friend, who was by this time almost exhausted.

The last few yards were very difficult; but just in time, after swimming for two hours, Smith felt ground under his feet, and dragged his helpless companion up on to the beach.

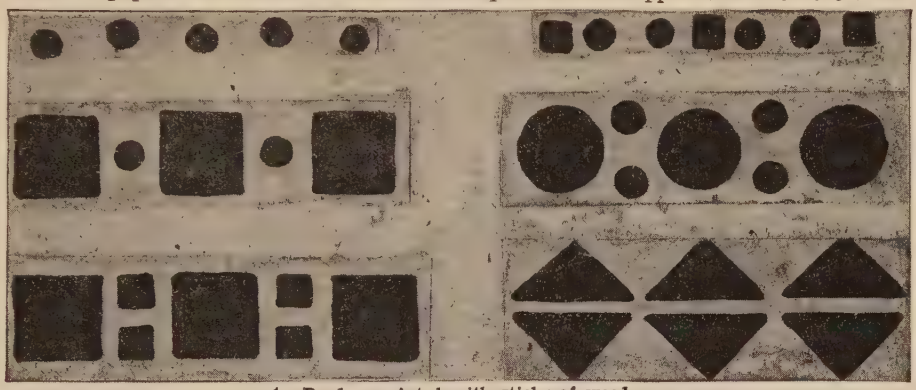
They were safe, but there were the men in the boat still to be rescued. Smith ran to the nearest village and two boats were manned and sent out; but by this time it was nearly dark and rain fell in torrents, so that hours were spent in searching for the overturned pinnace. Boats were also launched from the Seringapatam to find it, and at last it was discovered six miles away. The risk and effort had not been in vain.

The two brave boys were presented with silver medals by the Royal Humane Society, and some time after Smith gained another medal for rescuing two men who had fallen overboard.

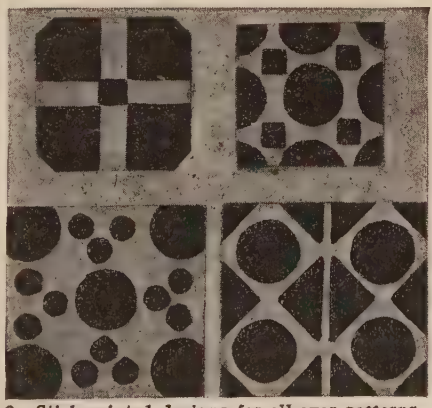
THE NEXT STORY OF GOLDEN DEEDS IS ON PAGE 229.

PRINTING ATTRACTIVE DESIGNS WITH STICKS OF WOOD

PERHAPS you haven't known that you may make attractive designs either on paper or on cloth with sticks of wood of various shapes. If you wish pleasing borders and surface designs for wallpaper, curtains, rugs or linoleums for a doll house, secure several sticks of fine- or close-grained wood. These should be at least one inch in length and as large on the ends as you want your designs. Then form the ends of these in the exact shapes desired, as suggested in picture 1. The largest squares were made from a stick about ½ inch square, and the triangles were made by diagonally cutting away one half of the square on the opposite end of the same stick. The circular shapes were made from ½ inch and 3-16 inch doweling (round), while the small squares were made from a stick about ¼ inch square. If desired, one end of each stick may be left plain, while the other can be modified in form to give a greater variety to the printing, as shown in picture 2.



1. Borders printed with sticks of wood.



2. Stick-printed designs for all-over patterns.

It should be noted that unless the end of each stick is entirely flat, the whole surface

will not be printed. If you are uncertain about this, you may test each one of your sticks by carefully dipping it in ink or paint and then steadily pressing it against a flat sheet of paper. If all parts of the design are not clear, the end of the stick may be made flat by sawing or sandpapering it until even.

If you do not have prepared color-pads, you may make your own by placing pieces of felt or flannel in tin covers, such as the tops of baking-powder cans. The prepared pads come in several colors, such as red, yellow, blue, and so on, but you may get good results by using common oil paints if you decide to make your own pads. In case you do use common oil paints, you should add a few drops of turpentine or benzine to each pad to thin the paint properly. If you use the prepared pads, these can be thinned with drops of water.

In either case, press the end of the stick first down on the pad and then immediately on the paper or cloth to be printed. Different color combinations may be made by pressing the stick first on one color pad and then on another before printing. For example, a combination of yellow and blue will give a green-colored print, while a combination of yellow and red will result in an orange print. Try various combinations until you secure the desired color. You will find it much easier to print if you place a moist blotter under the part of the paper or cloth to be decorated. If you intend to wash the cloth after it has been decorated, you should first make the color fast by covering it with a wet cloth and pressing it with a hot iron until it is entirely dry. Be sure to test the iron before putting it on the cloth because if it is too hot it may scorch your work.

JELLY CHILDREN CAN MAKE

DID you ever try to make your very own jelly? Some children enjoy making apple jelly for their parties, while others prefer making cranberry jelly for mother's Thanksgiving or Christmas dinner.

Apple jelly is quite easy to make if you have jelly apples at hand. Ask your mother or someone else who knows about this, unless you wish to find out for yourself. First you wash the apples carefully and cut them in pieces (quarters). Then you cook these in a small amount of water until soft. Now pour into a jelly bag (cloth) and allow to drip for some time or even overnight. Measure the strained juice in a cup and boil it for at least ten minutes. At this point add as many cupfuls of sugar as there was juice when you measured it. Then boil this until it jellies—a tiny thread will appear as the liquid drops from the spoon. When you are certain it has jellied, pour into jelly glasses and allow it to cool. When cool, melt enough paraffin to pour over the tops of each jelly glass.

Cranberry jelly is also easily made. You first carefully pick over, wash, and measure the cranberries. Then you put these in a kettle, adding about one half as much water as berries, and cook until the berries burst. After straining you should next measure the juice. You now boil this juice for several minutes, after which you add as much sugar as you had juice when measured. Finally you should cook this until it jellies—it will hang along the edge of your spoon and fall off in heavy drops. It is then ready to be poured into your jelly glasses to cool. A thin coat of melted paraffin can be poured over the tops of these when they have cooled. The paraffin keeps the air away from the jelly.

HOW TO MAKE SOAP FOR MOTHER

WHY not ask your mother to help you make a few pounds of good soap from the grease which she has saved? First be careful to use grease that is clean and free from salt. After melting about 1½ pounds of such grease in a kettle, place it aside to cool. At this point you should dissolve in a pint of cold water about ¼ pint of soda lye, which may be bought at the grocery store if your mother hasn't it on hand. As it dissolves, the water will become hot; you should be careful not to allow this solution of lye to burn your clothing or your skin.

By the time the melted grease has become lukewarm, the lye solution will have cooled enough so that it may be poured slowly into the grease. You should note the importance of pouring and stirring the lye into the grease rather than the opposite, as the same results will not be had if you pour and stir the grease into the lye. The stirring should continue only until the lye and grease have become so well mixed that you have a thick and smooth soap. Be careful to stop when you have such a mixture, and pour it into a wooden or metal box which has its surfaces covered either with paper or with cloth.

Your soft soap is now ready to cool. However, it is best to leave it covered with a paper for several hours. Before the soap becomes too hard it should be cut into cakes by using either fine string or wire. The size of the cake can be made to suit your taste, but a two-by-three proportion is usually found to be most attractive.

If you should find that your soap does not seem to be of fine enough grain to suit you, this is doubtless due to your failure to stir the mixture properly. This difficulty may be overcome by breaking the cakes into small pieces and melting them in about ¼ pint of water. This mixture can be remolded and then allowed to harden as before. If this does not suit, repeat the process. By using molds of different shapes you can have many interesting forms of soap cakes.

A USEFUL PAPER-KNIFE MADE OF WOOD OR METAL

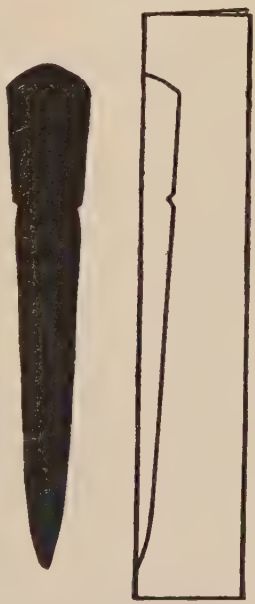
WOULD you like to make a handy paper-knife to open your letters and also to cut the pages of new magazines and books? Perhaps you would prefer making this useful gift for father or for some other member of the family. In either case, you can have lots of fun by designing and making it to suit your taste.

The designing of the paper-knife will be quite easy if you keep in mind what uses are to be made of it when finished. If you desire a knife that will open letters as well as cut paper, it is important that you provide for a point, as shown in the accompanying designs (picture 1). When you have decided upon the size and shape, the actual method of designing the paper-knife is merely to draw one-half of the pattern, or design, on a sheet of stiff paper which can be folded as illustrated in picture 2. This design may then be transferred to the thin wood or sheet-metal either by cutting and tracing the outlines of the pattern or by using carbon paper. A convenient length, including a handle, is found to range from 6 to 7 inches, depending somewhat upon the kind of design chosen. A satisfactory width for the handle will range from 5/8 to 7/8 of an inch, while the thickness will be determined largely by the material used. Although a handle is not necessary, it will be found that even the suggestion of a handle adds much to the general attractiveness of your knife. If the handle is decorated, the design should be made quite small and suitable to its form.

The making of your paper-knife will depend somewhat upon the materials which you have at hand. If you plan to make it of wood, secure an old cigar box or any soft wood about 1/8 or 3-16 of an inch in thickness, upon which you may transfer your pattern. As cigar boxes are usually made of cedar, these prove quite satisfactory for either whittling or scroll-saw work. In order to cut paper properly, the edges of the knife, from the handle to the point, must be beveled to suit this purpose. In finishing the knife the whole surface should be rubbed over with a dark oil stain of the desired color. In case the handle has been decorated, the design will be most effective if painted with bright water-colors, which must dry before the wood-stain is applied. These water-colors should be applied carefully with a brush which is not too full of color, in order to prevent these colors from spreading. When this is entirely dry and the oil stain has been rubbed, as explained, the paper-knife is completed by rubbing a final coat of floor or furniture wax with a soft cloth.

1. Suggestions for knife to open letters and cut paper.

On the other hand, you may choose to make the paper-knife of thin or sheet-metal which is available. Regardless of whether you use sheet-iron, sheet-copper or sheet-brass, a thickness less than 18-gauge or 20-gauge will be found too flexible for this purpose. After you have transferred your design, or pattern, to the 18-gauge soft sheet-copper, for example, cut on the outside of the line with a pair of tinners' shears. To remove any roughness and to improve the cutting edges, rub either with a fine file or with emery-cloth. If you have a round-headed hammer, you may easily decorate one or both surfaces of your paper-knife attractively by placing the metal on a solid flat metal base and hammering the surface at regular intervals with an even stroke. Now polish the knife thoroughly with pumice stone and water. A satisfactory color may be had by rubbing the surfaces with turpentine, then holding it high over a small flame until the desired shade is fixed. Lacquer may be used to preserve this, if desired.



2. How the paper-knife is designed.

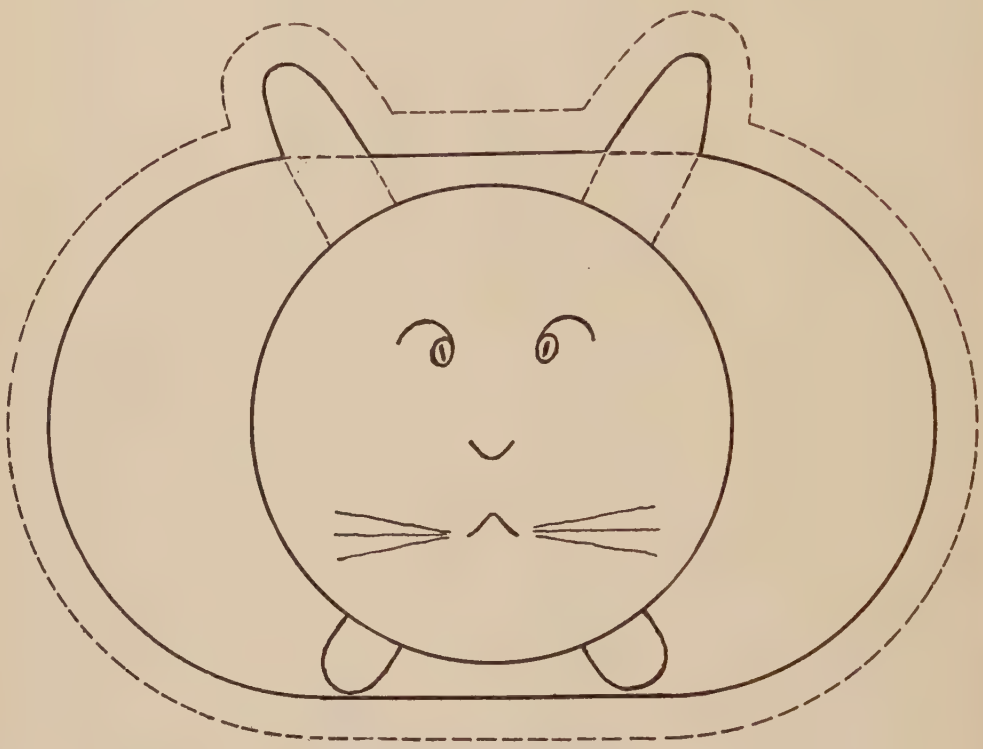
It is possible to make paper-knives which are odd in shape yet which are useful and beautiful. For instance, the blade may have a curve like that of a Turkish scimitar, or it may be as fine and straight as a rapier. Any design can be worked out by a careful boy or girl.

MAKING AN INTERESTING BEAN-BAG

IS there a little girl or boy anywhere that does not enjoy playing bean-bag? Wouldn't it be nice for sister to make this one for her little brother or sister? You will notice that this bag shows the face of a kitty with its ears up straight, just like a real one. The following directions will make a bean-bag like the one shown.

1. Obtain two pieces of plain cloth, such as unbleached muslin.

2. Put a piece of tissue paper over the picture and trace the outside dotted lines.



Pattern for bean-bag design.

Then take carbon paper and trace this form on one of your pieces of cloth. Now place both pieces of cloth together and cut around the pattern.

3. Use tissue paper, as before, to copy the kitty (face, ears, eyes, nose, mouth, mustache and feet). Next put carbon paper over *only one* piece of cloth and trace off the kitty design.

4. Embroider kitty, using the simple outline stitch. You may use any color floss you have (black is quite effective).

5. Place the two right sides of the goods together and baste all the way around, leaving an opening at the bottom of about 1½ inches in which to put the beans.

6. Sew up, either on the sewing-machine or by using backstitching.

Do you know what makes kitty's ears stand up straight? Of course they are stuffed full of cotton. After you have stuffed kitty's ears, turn your bag right side out and sew across the bottom of the ears to keep the cotton in place. You can see where to do this from the dotted lines in the picture.

Now you are ready to fill your bag with beans. It should not be too full, but just enough to make your bag plump. After filling use overhand or whipping stitch to sew the opening of the bag together. All ready for a game! If you happen to be making this bag in the spring at about the time mother is canning cherries, ask her to save a quantity of pits for you. You may dry these and pour them into your bag. They are just as good as, if not better than, beans.

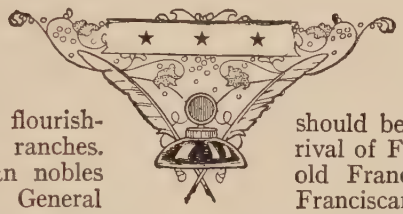
If you cannot get beans or cherry stones, perhaps you live where corn is grown. When an ear of corn is quite ripe the kernels become yellow and hard. Then they can be stripped from the cob quite easily. If you rub your hand gently over the ear of corn you can rub off the kernels. It will be found that these corn kernels are quite as useful as beans when it comes to filling a bag. Boys and girls in North America may be interested to know that little children in far-off Macedonia play games with bags filled with corn kernels. And their games are quite like ours.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 231.

A STORY OF CALIFORNIA

IN 1883 Mrs. Helen Jackson was appointed a special commissioner to investigate the conditions and needs of the Mission Indians in California. The following year she wrote Ramona. Probably this is the best story yet written of California in the days immediately following the taking of the coast state from Mexico. Mrs. Jackson wrote her book to show how unjust had been the treatment of the conquered peoples. But that is not its greatest interest. The pen pictures of life on a great ranch and among the Indian settlements are very vivid. The close link between the people of all classes and the Missions is clearly shown. When we look at the ruins of these famous old Missions we can understand much more what they stood for if we have read Ramona.

RAMONA



BEFORE the taking of California by the United States that beautiful land was clothed with flourishing Missions and ranches. Many of the Mexican nobles owned vast estates. General Moreno, a leading soldier, had been given forty square miles of land between the San Fernando Mountains and the sea. There he had built his home, and to it had brought as his bride the beautiful, proud Señorita Gonzaga. At the Moreno ranch open-handed hospitality was the rule. Every passing stranger was welcomed, and General Moreno's house became a gathering-place for the whole countryside.

But in the war between Mexicans and Americans the General was killed. Señora Moreno and her little son Felipe were deprived of a large section of their property by the United States Land Commission. The Missions also lost much of their property. Many Mexicans left California and returned to Mexico. Some whose fortunes were in the land remained, but they hated with a great bitterness the English-speaking newcomers who now possessed California.

Felipe grew into a handsome young man, and was supposed to be in control of the ranch. His mother really managed everything, but she was so clever that Felipe did not suspect that he was being led by her. At the moment the story opens Señora Moreno had arranged that the sheep-shearing should be put off until the arrival of Father Salvierderra, an old Franciscan priest. This Franciscan father had known Señora Moreno from her childhood, and he had always come to the Moreno home at shearing time to give his blessing. Everyone looked forward to the coming of the old man, who was dearly loved. The member of the household who was most eager was probably Ramona Ortegna.

Ramona occupied the position of a daughter in the Moreno family, but she was really no relation by blood to Señora Moreno. The Señora's sister had in her youth been in love with a Scotsman named Angus Phail. While Phail, who was a wealthy shipowner, was away on a voyage Ramona Gonzaga married Francis Ortegna. Her husband proved to be a very cruel man. Angus Phail almost went mad, and he became a drunkard. For twenty-five years he did not see Señora Ortegna. Then one day he appeared at her home with a little baby girl whom he asked his former sweetheart to adopt. The mother of the child had been an Indian woman. The Señora Ortegna adopted the baby and called it Ramona, as that had been Phail's wish. When she felt she was dying, the Señora sent for her sister, Señora Moreno, and gave the

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little Ramona into her charge as a sacred trust. Some jewels were also handed over to the Señora Moreno to be given to the adopted child when she grew up.

Señora Moreno took the little Ramona home to the ranch and brought her up as if she were Felipe's sister. But Ramona always felt that the Señora had no real love for her and gave her very little affection. Felipe noticed this too, and tried to be as kind as possible to the child.

Years passed. At the time the ranch was waiting for Father Salvierderra, Ramona had become a beautiful young woman. Not only was she beautiful, but she was good. Everyone loved her. On the day of Father Salvierderra's arrival the sheep-shearers were expected. Through the carelessness of one of the maids the altar-cloth for the ranch chapel had been torn and soiled. Ramona mended it, and was washing out the stains in the brook when the shearers arrived. Their leader, Alessandro, an Indian, saw her from between the branches of an old willow and was overcome by her beauty.

But it was not until Felipe, who had fallen ill again, became delirious that Ramona and Alessandro really met. The young Indian sang gloriously and played the violin with much skill and feeling. His playing and singing quieted Felipe's raving. When Juan Canito, the ranch foreman, broke his leg, Señora Moreno asked Alessandro to take his place for a time. Alessandro consented.

Few at the Moreno ranch realized that Alessandro was the son of an Indian chief and that he himself owned almost as many sheep as did the Señora Moreno. Moreover, his father, Chief Pablo, had brought his son up to have high ideals. At Temecula, the village in the centre of Pablo's possessions, Alessandro was beloved of everyone.

As Felipe became stronger his mother grew jealous of his desire to see Ramona near him. At the slightest excuse she would send the girl away from Felipe's bedside. But Felipe was constantly asking for Alessandro to play and sing for him. More often than not Ramona would carry the message. Unfortunately, as she was searching for the Indian she came upon him talking to Margarita, one of the maids. Margarita was very angry and began to hate Ramona; and her hate grew when she saw that Alessandro loved her young mistress.

The love between the Indian and the girl increased every day. Felipe encouraged it as much as he could. But one afternoon the Señora came suddenly upon the pair among the willows. She was furiously angry and sent Ramona to her room, where she locked her in. The next day she forbade the girl to have anything to do with Alessandro. Ramona answered that she intended to marry the Indian.

To try to break Ramona's will the Señora told her the story of Angus Phail and of her adoption by Señora Ortegna. When the girl found that her own mother was an Indian she was overjoyed, and more determined than ever to marry Alessandro. Señora Moreno then showed her the jewels that had been left for her, but said that Ramona should never get them if she did not give up the Indian. Ramona still refused. Finally the Señora said that Ramona should be sent to a convent. Ramona decided that she would run away with Alessandro.

But Alessandro had returned to Temecula, as his father had sent for him. There he found a terrible state of affairs. The American Government had seized all his father's land, and even his sheep and cattle. Worse still, the Government officials had turned all the Indians out of the village. Instead of being rich, Alessandro was extremely poor. And he was almost insane when he thought he could not ask Ramona to marry him now. His father died of grief, and that was a terrible blow.

He returned to the Moreno ranch secretly to look once again at Ramona. She saw him, however, and insisted that she would go away with him. Taking only a few belongings and her horse Baba, she left the ranch. Alessandro gave her the Indian name Majella, which means "dove." She was married at the San Diego Mission under the name Majella Fayeel. The last name was as near as the good priest could come to spelling Phail.

Alessandro and his bride rode to the San Pasquale Valley. There he had a piece of good fortune, for he recovered a herd of his father's cattle and some sheep. In the peaceful and beautiful valley they lived happily for a year and a half. A little daughter was born to them and was named Ramona. But again the long arm of the Government reached out. Into the

valley came men who declared that the Indians had no right to the land on which they were living. Again, in bitterness and grief, Alessandro and Ramona had to start out with nothing.

Meanwhile the Señora Moreno had died. Felipe set out to find Ramona and Alessandro; but because Ramona had married under the name of Majella Fayeel, he could find no trace of her. Yet he did not despair. Again and again he tried. Some of those he asked would not tell him because they thought they were protecting Ramona. Even old Carmena, an Indian woman whom he knew, declared she knew nothing.

All the while Alessandro and his wife and baby were suffering severe hardships in the San Jacinto Valley. To make matters worse, the baby became ill, and the white doctor refused to ride thirty miles to help an Indian. Jos and Maria Hyer, two settlers from Tennessee, did their best for poor Ramona in her trouble. Other settlers were not so friendly, and Alessandro's wife began to feel a terror that more trouble was coming to them.

She was right. Alessandro rode home from sheep-shearing on a pony that was not his own. In the darkness he had mounted the wrong animal. Before he had time to ride back and make the exchange, a band of rough settlers appeared at his home. They accused him of horse-theft and shot him before Ramona's eyes. He died at once.

In the words of the book we shall give an account of the finding of Ramona by Felipe immediately after Alessandro's death.

FELIPE FINDS RAMONA

EFFECTUALLY misled by the faithful Carmena, Felipe had begun his search for Alessandro by going direct to Monterey. He found few Indians in the place, and not one had ever heard Alessandro's name. Six miles from the town was a little settlement of them, in hiding, in the bottoms of the San Carlos River, near the old Mission. The Catholic priest advised him to search there; sometimes, he said, fugitives of one sort and another took refuge in this settlement, lived there for a few months, then disappeared as noiselessly as they had come. Felipe searched there also; equally in vain.

He questioned all the sailors in port; all the shippers. No one had heard of an Indian shipping on board any vessel; in fact, a captain would have to be in straits before he would take an Indian in his crew.

"But this was an exceptionally good worker, this Indian; he could turn his hand to anything; he might have gone as ship's carpenter."

"That might be," they said; "nobody had ever heard of any such thing, however"; and very much they all wondered what it was that made the handsome, sad, Mexican gentleman so anxious to find this Indian.

Felipe wasted weeks in Monterey. Long after he had ceased to hope, he lingered. He felt as if he would like to stay till every ship that had sailed out of Monterey in the last three years had returned. Whenever he heard of one coming into harbor, he hastened to the shore, and closely watched the disembarking. His melancholy countenance, with its eager, searching look, became a familiar sight to every one; even the children knew that the pale gentleman was looking for some one he could not find. Women pitied him, and gazed at him tenderly, wondering if a man could look like that for anything save the loss of a sweetheart. Felipe made no confidences. He simply asked, day after day, of every one he met, for an Indian named Alessandro Assis.

Finally he shook himself free from the dreamy spell of the place, and turned his face southward again. He went by the route which the Franciscan Fathers used to take, when the only road on the California coast was the one leading from Mission to Mission. Felipe had heard Father Salvierderra say that there were in the neighborhood of each of the old Missions Indian villages, or families still living. He thought it not improbable that, from Alessandro's father's long connection with the San Luis Rey Mission, Alessandro might be known to some of these Indians. He would leave no stone unturned; no Indian village unsearched; no Indian unquestioned.

San Juan Bautista came first; then Soledad, San Antonio, San Miguel, San Luis Obispo, Santa Inez; and that brought

him to Santa Barbara. He had spent two months on the journey. At each of these places he found Indians; miserable, half-starved creatures, most of them. Felipe's heart ached, and he was hot with shame, at their condition. The ruins of the old Mission buildings were sad to see, but the human ruins were sadder. Now Felipe understood why Father Salvierderra's heart had broken, and why his mother had been full of such fierce indignation against the heretic usurpers and despoilers of the estates which the Franciscans once held. He could not understand why the Church had submitted, without fighting, to such indignities and robberies. At every one of the Missions he heard harrowing tales of the sufferings of those Fathers who had clung to their congregations to the last, and died at their posts. At Soledad an old Indian, weeping, showed him the grave of Father Sarria, who had died there of starvation. "He gave us all he had, to the last," said the old man. "He lay on a raw-hide on the ground, as we did; and one morning, before he had finished the Mass, he fell forward at the altar and was dead. And when we put him in the grave, his body was only bones, and no flesh; he had gone so long without food, to give it to us."

At all these Missions Felipe asked in vain for Alessandro. They knew very little, these northern Indians, about those in the south, they said. It was seldom one from the southern tribes came northward. They did not understand each other's speech. The more Felipe inquired, and the longer he reflected, the more he doubted Alessandro's having ever gone to Monterey. At Santa Barbara he made a long stay. The Brothers at the College welcomed him hospitably. They had heard from Father Salvierderra the sad story of Ramona, and were distressed, with Felipe, that no traces had been found of her. It grieved Father Salvierderra to the last, they said; he prayed for her daily, but said he could not get any certainty in his spirit of his prayers being heard. Only the day before he died, he had said this to Father Francis, a young Brazilian monk, to whom he was greatly attached.

In Felipe's overwrought frame of mind this seemed to him a terrible omen; and he set out on his journey with a still heavier heart than before. He believed Ramona was dead, buried in some unknown, unconsecrated spot, never to be found; yet he would not give up the search. As he journeyed southward, he began to find persons who had known of Alessandro: and still more, those who had known his father, old Pablo. But no one had heard anything of Alessandro's whereabouts since the driving out of his people from Temecula; there was no knowing where any of those Temecula people were now. They had scattered "like a flock of ducks," one Indian said,—"like a flock of ducks after they are fired into. You'd never see all those ducks in any one place again. The Temecula people were here, there, and everywhere, all through San Diego County. There was one Temecula man at San Juan Capistrano, however. The Señor would better see him. He no doubt knew about Alessandro. He was living in a room in the old Mission building. The priest had given it to him for taking care of the chapel and the priest's room, and a little rent besides. He was a hard man, the San Juan Capistrano priest; he would take the last dollar from a poor man."

It was late at night when Felipe reached San Juan Capistrano; but he could not sleep till he had seen this man. Here was the first clew he had gained. He found the man, with his wife and children, in a large corner room opening on the inner court of the Mission quadrangle. The room was dark and damp as a cellar; a fire smouldered in the enormous fireplace; a few skins and rags were piled near the hearth, and on these lay the woman, evidently ill. The sunken tile floor was icy cold to the feet; the wind swept in at a dozen broken places in the corridor side of the wall; there was not an article of furniture. "Heavens!" thought Felipe, as he entered, "a priest of our Church take rent for such a hole as this!"

There was no light in the place, except the little which came from the fire. "I am sorry I have no candle, Señor," said the man, as he came forward. "My wife is sick, and we are very poor."

"No matter," said Felipe, his hand already at his purse. "I only want to ask you a few questions. You are from Temecula, they tell me."

"Yes, Señor," the man replied in a dogged tone,—no man of Temecula could yet hear the word without a pang,—"I was of Temecula."

"I want to find one Alessandro Assis

who lived there. You knew him, I suppose," said Felipe, eagerly.

At this moment a brand broke in the smouldering fire, and for one second a bright blaze shot up; only for a second, then all was dark again. But the swift blaze had fallen on Felipe's face, and with a start which he could not control, but which Felipe did not see, the Indian had recognized him. "Ha, ha!" he thought to himself. "Señor Felipe Moreno, you came to the wrong house asking for news of Alessandro Assis!"

It was Antonio,—Antonio, who had been at the Moreno sheep-shearing; Antonio, who knew even more than Carmena had known, for he knew what a marvel and miracle it seemed that the beautiful Señorita from the Moreno house should have loved Alessandro, and wedded him; and he knew that on the night she went away with him, Alessandro had lured out of the corral a beautiful horse for her to ride. Alessandro had told him all about it,—Baba, fiery, splendid Baba, black as night, with a white star in his forehead. Saints! but it was a bold thing to do, to steal such a horse as that, with a star for a mark; and no wonder that even now, though near three years afterwards, Señor Felipe was in search of him. Of course it could be only the horse he wanted. Ha! much help might he get from Antonio!

"Yes, Señor, I knew him," he replied.

"Do you know where he is now?"

"No, Señor."

"Do you know where he went, from Temecula?"

"No, Señor."

"A woman told me he went to Monterey. I have been there looking for him."

"I heard, too, he had gone to Monterey."

"Where did you see him last?"

"In Temecula."

"Was he alone?"

"Yes, Señor."

"Did you ever hear of his being married?"

"No, Señor."

"Where are the greater part of the Temecula people now?"

"Like this, Señor," with a bitter gesture, pointing to his wife. "Most of us are beggars. A few here, a few there. Some have gone to Capitain Grande, some way down into Lower California."

Wearily Felipe continued his bootless questioning. No suspicion that the man was deceiving him crossed his mind. At last, with a sigh, he said, "I hoped to have found Alessandro by your means. I am greatly disappointed."

"I doubt not that, Señor Felipe Moreno," thought Antonio. "I am sorry, Señor," he said.

It smote his conscience when Felipe laid in his hand a generous gold-piece, and said, "Here is a bit of money for you. I am sorry to see you so poorly off."

The thanks which he spoke sounded hesitating and gruff, so remorseful did he feel. Señor Felipe had always been kind to them. How well they had fared always in his house! It was a shame to lie to him; yet the first duty was to Alessandro. It could not be avoided. And thus a second time help drifted away from Ramona.

At Temecula, from Mrs. Hartsel, Felipe got the first true intelligence of Alessandro's movements; but at first it only confirmed his worst forebodings. Alessandro had been at Mrs. Hartsel's house; he had been alone, and on foot; he was going to walk all the way to San Pasquale, where he had the promise of work.

How sure the kindly woman was that she was telling the exact truth. After long ransacking of her memory and comparing of events, she fixed the time so nearly to the true date, that it was to Felipe's mind a terrible corroboration of his fears. It was, he thought, about a week after Ramona's flight from home that Alessandro had appeared thus, alone, on foot, at Mrs. Hartsel's. In great destitution, she said; and she had lent him money on the expectation of selling his violin; but they had never sold it; there it was yet. And that Alessandro was dead, she had no more doubt than that she herself was alive; for else, he would have come back to pay her what he owed. The honestest fellow that ever lived, was Alessandro. Did not the Señor Moreno think so? Had he not found him so always? There were not many such Indians as Alessandro and his father. If there had been, it would have been better for their people. "If they'd all been like Alessandro, I tell you," she said, "it would have taken more than any San Diego sheriff to have put them out of their homes here."

"But what could they do to help themselves, Mrs. Hartsel?" asked Felipe. "The law was against them. We can't

any of us go against that. I myself have lost half my estate in the same way."

"Well, at any rate they wouldn't have gone without fighting!" she said. "'If Alessandro had been here!' they all said."

Felipe asked to see the violin. "But that is not Alessandro's," he exclaimed. "I have seen his."

"No!" she said. "Did I say it was his? It was his father's. One of the Indians brought it in here to hide it with us at the time they were driven out. It is very old, they say, and worth a great deal of money, if you could find the right man to buy it. But he has not come along yet. He will, though. I am not a bit afraid but that we'll get our money back on it. If Alessandro was alive, he'd have been here long before this."

Finding Mrs. Hartsel thus friendly, Felipe suddenly decided to tell her the whole story. Surprise and incredulity almost overpowered her at first. She sat buried in thought for some minutes; then she sprang to her feet, and cried: "If he's got that girl with him, he's hiding somewhere. There's nothing like an Indian to hide; and if he is hiding, every other Indian knows it, and you just waste your breath asking any questions of any of them. They will die before they will tell you one thing. They are as secret as the grave. And they, every one of them, worshipped Alessandro. You see they thought he would be over them, after Pablo, and they were all proud of him because he could read and write, and knew more than most of them. If I were in your place," she continued, "I would not give it up yet. I should go to San Pasquale. Now it might just be that she was along with him that night he stopped here, hid somewhere, while he came in to get the money. I know I urged him to stay all night, and he said he could not do it. I don't know, though, where he could possibly have left her while he came here."

Never in all her life had Mrs. Hartsel been so puzzled and so astonished as now. But her sympathy, and her confident belief that Alessandro might yet be found, gave unspeakable cheer to Felipe.

"If I find them, I shall take them home with me, Mrs. Hartsel," he said as he rode away; "and we will come by this road and stop to see you." And the very speaking of the words cheered him all the way to San Pasquale.

But before he had been in San Pasquale an hour, he was plunged into a perplexity and disappointment deeper than he had yet felt. He found the village in disorder, the fields neglected, many houses deserted, the remainder of the people preparing to move away. In the house of Ysidro, Alessandro's kinsman, was living a white family,—the family of a man who had pre-empted the greater part of the land on which the village stood. Ysidro, profiting by Alessandro's example, when he found that there was no help, that the American had his papers from the land-office, in all due form, certifying that the land was his, had given the man his option of paying for the house or having it burned down. The man had bought the house; and it was only the week before Felipe arrived, that Ysidro had set off, with all his goods and chattels, for Mesa Grande. He might possibly have told the Señor more, the people said, than any one now in the village could; but even Ysidro did not know where Alessandro intended to settle. He told no one. He went to the north. That was all they knew.

To the north! That north which Felipe thought he had thoroughly searched. He sighed at the word. The Señor could, if he liked, see the house in which Alessandro had lived. There it was, on the south side of the valley, just on the edge of the foothills; some Americans lived in it now. Such a good ranch Alessandro had; the best wheat in the valley. The American had paid Alessandro something for it,—but they did not know how much; but Alessandro was very lucky to get anything. If only they had listened to him. He was always telling them this would come. Now it was too late for most of them to get anything for their farms. One man had taken the whole of the village lands, and he had bought Ysidro's house because it was the best; and so they would not get anything. They were utterly disheartened, broken-spirited.

In his sympathy for them, Felipe almost forgot his own distresses. "Where are you going?" he asked of several.

"Who knows, Señor?" was their reply. "Where can we go? There is no place."

When, in reply to his questions in regard to Alessandro's wife, Felipe heard her spoken of as "Majella," his perplexity deepened. Finally he asked if no one had ever heard the name Ramona.

"Never."

What could it mean? Could it be possible that this was another Alessandro than the one of whom he was in search? Felipe bethought himself of a possible marriage-record. Did they know where Alessandro had married this wife of his, of whom every word they spoke seemed both like and unlike Ramona?

Yes. It was in San Diego they had been married, by Father Gaspara.

Hoping against hope, the baffled Felipe rode on to San Diego; and here, as ill-luck would have it, he found, not Father Gaspara, who would at his first word have understood all, but a young Irish priest, who had only just come to be Father Gaspara's assistant. Father Gaspara was away in the mountains, at Santa Ysabel. But the young assistant would do equally well to examine the records. He was courteous and kind; brought out the tattered old book, and, looking over his shoulder, his breath coming fast with excitement and fear, there Felipe read, in Father Gaspara's hasty and blotted characters, the fatal entry of the names, "Alessandro Assis and Majella Fa—"

Heart-sick, Felipe went away. Most certainly Ramona would never have been married under any but her own name. Who, then, was this woman whom Alessandro Assis had married in less than ten days from the night on which Ramona had left her home? Some Indian woman for whom he felt compassion, or to whom he was bound by previous ties? And where, in what lonely, forever hidden spot, was the grave of Ramona?

Now at last Felipe felt sure that she was dead. It was useless searching farther. Yet, after he reached home, his restless conjectures took one more turn, and he sat down and wrote a letter to every priest between San Diego and Monterey, asking if there were on his books a record of the marriage of one Alessandro Assis and Ramona Ortegna.

It was not impossible that there might be, after all, another Alessandro Assis. The old Fathers, in baptizing their tens of thousands of Indian converts, were sore put to it to make out names enough. There might have been another Assis besides old Pablo, and of Alessandros there were dozens everywhere.

This last faint hope also failed. No record anywhere of an Alessandro Assis, except in Father Gaspara's book.

As Felipe was riding out of San Pasquale, he had seen an Indian man and woman walking by the side of mules heavily laden. Two little children, too young or too feeble to walk, were so packed in among the bundles that their faces were the only part of them in sight. The woman was crying bitterly. "More of these exiles. God help the poor creatures!" thought Felipe; and he pulled out his purse, and gave the woman a piece of gold. She looked up in as great astonishment as if the money had fallen from the skies. "Thanks! Thanks, Señor!" she exclaimed; and the man coming up to Felipe said also, "God reward you, Señor! That is more money than I had in the world! Does the Señor know of any place where I could get work?"

Felipe longed to say, "Yes, come to my estate; there you shall have work!" In the olden time he would have done it without a second thought, for both the man and the woman had good faces,—were young and strong. But the pay-roll of the Moreno estate was even now too long for its dwindled fortunes. "No, my man, I am sorry to say I do not," he answered. "I live a long way from here. Where were you thinking of going?"

"Somewhere in San Jacinto," said the man. "They say the Americans have not come in there much yet. I have a brother living there. Thanks, Señor; may the saints reward you!"

"San Jacinto!" After Felipe returned home, the name haunted his thoughts. The grand mountain-top bearing that name he had known well in many a distant horizon. "Juan Can," he said one day, "are there many Indians in San Jacinto?"

"The mountain?" said Juan Can.

"Ay, I suppose, the mountain," said Felipe. "What else is there?"

"The valley, too," replied Juan. "The San Jacinto Valley is a fine, broad valley, though the river is not much to be counted on. It is mostly dry sand a good part of the year. But there is good grazing. There is one village of Indians I know in the valley; some of the San Luis Rey Indians came from there; and up on the mountain is a big village; the wildest Indians in all the country live there. Oh, they are fierce, Señor!"

The next morning Felipe set out for San Jacinto. Why had no one mentioned, why had he not himself known of, these villages? Perhaps there were yet others

he had not heard of. Hope sprang in Felipe's impressionable nature as easily as it died. An hour, a moment, might see him both lifted up and cast down. When he rode into the sleepy little village street of San Bernardino, and saw, in the near horizon, against the southern sky, a superb mountain-peak, changing in the sunset lights from turquoise to ruby, and from ruby to turquoise again, he said to himself, "She is there! I have found her!"

The sight of the mountain affected him, as it had always affected Aunt Ri, with an indefinable, solemn sense of something revealed, yet hidden. "San Jacinto?" he said to a bystander, pointing to it with his whip.

"Yes, Señor," replied the man. As he spoke, a pair of black horses came whirling round the corner, and he sprang to one side, narrowly escaping being knocked down. "That Tennessee fellow'll run over somebody yet, with those black devils of his, if he don't look out," he muttered, as he recovered his balance.

Felipe glanced at the horses, then driving his spurs deep into his horse's sides, galloped after them. "Baba! by God!" he cried aloud in his excitement; and forgetful of everything, he urged his horse faster, shouting as he rode, "Stop that man! Stop that man with the black horses!"

Jos, hearing his name called on all sides, reined in Benito and Baba as soon as he could, and looked around in bewilderment to see what had happened. Before he had time to ask any questions, Felipe had overtaken him, and riding straight to Baba's head, had flung himself from his own horse and taken Baba by the rein, crying, "Baba! Baba!" Baba knew his voice, and began to whinny and plunge. Felipe was nearly unmanned. For the second, he forgot everything. A crowd was gathering around them. It had never been quite clear to the San Bernardino mind that Jos's title to Benito and Baba would bear looking into; and it was no surprise, therefore, to some of the onlookers, to hear Felipe cry in a loud voice, looking suspiciously at Jos, "How did you get him?"

. . . . . .

The rest of the story we shall tell in short form.

Jos was quite willing to give Felipe all the information the young man asked for, and said frankly that the horses belonged to an Indian on San Jacinto. Felipe was overcome with joy, for he knew that this Indian must be Alessandro, and he asked Jos to conduct him to his home. Jos agreed willingly, glad that good fortune had come to the gentle Ramona. The two men arrived at Jos's house to be met by the terrible news that an Indian had come down from the mountains bearing a message to the Indian agent that Alessandro had been murdered. Felipe was stunned by the tidings, and exclaimed that he was too late, as Ramona would have died of the shock. But Jos's mother, Aunt Ri, said that Ramona would not die while the baby lived.

Felipe rode out to Ramona's cabin with Aunt Ri, the Maria Hyer who had been kind to the little forlorn family. He found Ramona dazed by the tragedy that had so suddenly taken her husband from her. At once he determined to take her back to the Moreno ranch.

The man who had shot Alessandro was tried, but was freed immediately. At that time in the history of the United States the murder of an Indian did not count for much. The guilty man at once fled from the valley, for he knew that if the real evidence were brought out even a callous jury might not free him again. Felipe swore to shoot the murderer like a dog if he found him. But the search was without result.

The home-coming to the ranch was a sad one, but everyone welcomed Ramona with a heart full of love. Felipe was very gentle and tender. When Ramona was better he gave her the jewels that his mother had kept from her. At her request it was arranged that these should be used for the benefit of her little daughter. Ramona herself would not touch them.

But Felipe felt that the old California had passed. He could no longer bear to live on the ranch with the constant stream of American settlers pouring into the country. So he sold all his property. With Ramona and her child he set out for Mexico.

At Monterey, as they were preparing to sail, he asked Ramona to be his wife. She told him she could not love him as she had loved Alessandro, but he was content to take what love she could give. They were married in Mexico.

THE NEXT STORY OF FAMOUS BOOKS IS ON PAGE 267.

WHAT THIS STORY TELLS US

THE earth was not exactly the same yesterday as it is to-day. The surface is constantly changing. The hills are being worn away, and other places are building up. Plants change the elements in the soil into leaves and branches. Such changes have been going on for more years than we can count. We take coal or oil out of the earth and burn them. Yet nothing is lost in spite of all these changes. The plant dies or is eaten by an animal, but what it contains is turned into something else. This story tells us some of the great changes that have taken place in the history of the ball we live upon. It also gives the explanation of these changes so far as the men who have studied them all their lives have been able to discover. What we tell you is the result of hundreds of years of study by many men.

HOW THE EARTH WAS MADE

CONTINUED FROM 25

AND now we must ask ourselves more particularly the great question, Where have the sun and the earth come from, and what were they like at first? For a long time men used to think that the solar system, including the sun and the earth, had been from the first as they are now. Few people now think that. We believe that they have grown, so to speak, to be what they are, and we have a fairly good idea of the way they came. In order to see what the solar system was probably like at first we have only to take a telescope and look up at the sky. There we shall see scores of thousands of wonderful bodies which seem to be still at the stage reached by the solar system long ages ago. These bodies are called nebulæ, and one of them would be called a *nebula,* which is the Latin word for "cloud." They look like little bright fleecy clouds in the sky. Some of them can be seen with the naked eye, and then they look like stars; but they are quite different from stars.

By examining the kind of light they send to us, we know that the sky contains, at the very least, 120,000 real nebulæ. They are not star-clusters at all, but glowing clouds of matter. Perhaps we can get the best idea of what a nebula is like by using the name the poets often call it by—*fire-mist.*

A nebula is like a great mist of fire. Those we see in the heavens are of different shapes and sizes. Many of them are far bigger, hundreds of thousands of times bigger, than the whole space occupied by the solar system. A great many of them have a shape like the firework called St. Catherine's wheel — flattened and coiled up. They are called spiral nebulæ. You know what a spiral staircase is. The spiral nebulæ, however, ought never to have had that name, because they are not at all like a spiral staircase; they are flat and thin, more like a St. Catherine's wheel in shape.

If we look at some of these spiral nebulæ we see bright points in them here and there which suggest to us that the fire-mist has become thicker at certain places than at others. Often these bright points are so large and bright that they look like stars. It is possible that they are stars. Possibly all stars are made out of nebulæ.

If you could look at the solar system from a great distance away you would notice many remarkable facts about it. In the first place, you would notice that nearly all the twistings and movements are in one direction; then you would notice that the solar system is a flat thing. All the planets, so to speak, go round the sun at much the same level.

There is another curious fact, and that is that the kind of stuff the sun is made of is very much the same stuff that the various planets are made of. It almost looks—does it not?—as if our little earth and all the planets were once a part of the sun.

And so men guessed that perhaps the pieces of stuff that now make the planets had been somehow brushed off

they had become solid and started traveling round and round it. We are sure now that that is not what happened, but we are also sure that the idea was right. The sun and all its planets were once one.

Indeed, we believe that in its first stage the solar system was nothing else than a nebula, like one of the very smallest of the thousands in the sky. We are not certain how such a nebula would gradually become changed into the solar system that we know. It seems to be certain, however, that a nebula is apt to become flattened and to take on the shape of a St. Catherine's wheel. Far too many of the nebulæ are of that shape for us to imagine that there is not some good reason why they should be so, and we have little doubt that if we could live long enough to watch the nebulæ that are not spiral we should see them gradually become so.

Now, there is one great force that must always be at work in a nebula like this. It is a force which acts everywhere; and though it has rather a long name, it is not difficult to describe. We are certain that in the course of time this force must work great changes in a nebula—such changes as we believe to have been worked in the nebula from which the present solar system was formed.

WHAT SIR ISAAC NEWTON THOUGHT UNDER AN APPLE TREE

This force is called gravitation, and it acts in such a way that it causes every tiny piece of matter in the world to be attracted by all other matter in the world. Gravitation is, perhaps, the most familiar of all facts in our daily lives. When you let a ball out of your hand it drops to the earth simply because the earth and the ball have attracted each other.

One of the greatest men that ever lived, an Englishman called Isaac Newton, was lying on his back under the shade of an apple tree in his mother's garden. He was not just dreaming his time away, however, but thinking; and he saw what thousands of people had seen before him, but never troubled to think about—an apple falling from the tree to the ground. The result of his thinking about this was that he discovered a law of attraction which is true throughout the whole universe, not only of the earth and a ball, but also of the earth and the moon, the earth and the sun, and also of all the little pieces of matter in a nebula.

formed, then—perhaps by a collision between two stars or more—there would begin to act upon all its parts the same force of gravitation which acts upon you if you miss your footing and tumble downstairs—a force that goes on acting all the time, never ceasing and never getting tired. So, some years after the great work of Newton, several men began to apply his ideas to the nebulæ (remember that when the word is spelled like this it means more than one nebula) and to ask what must happen in the course of ages when this force of attraction acts upon a nebula.

THE HEAVENS LIKE A GARDEN FILLED WITH BLOSSOMING WORLDS

One of the greatest of these followers of Newton was Herschel, who made finer telescopes than anyone had used before, and who spent all his life studying the stars and the nebulæ. He was the first man that ever made a list of nebulæ, and he it was who first saw that they might be arranged in classes, from those which look like little milky clouds, and nothing more, to those which seem to be stars with a sort of cloudy substance round them.

So it seemed to him that some "clustering power" must be at work turning these scattered and milky nebulæ into brighter and smaller objects which would some day become stars or suns and solar systems, and he compared the heavens to a rich garden containing plants in all stages of their lives. This gives us the advantage, he says, that as at one and the same time we can see all the different stages in the history of plants—from their birth to their death—so also in the heavens we can see all the different stages from a nebula to a star. Then there followed a great Frenchman named Laplace, who saw that the "clustering power" must be gravitation, and who worked out what he thought must happen in such a case, as we know the force with which gravitation acts."

THE SPACE THAT SWARMS WITH WORLDS LIKE PEBBLES

Now, in order to fill in the history of the solar system we have to reckon with two facts. We have already seen that the sun and his family do not stand still in space, but are moving all together through it. We cannot, indeed, believe that there is rest anywhere; everything is moving. But for a long time this movement of the nebula from which the solar sys-

portant; at any rate, there seemed no reason why it should help us to understand how the solar system was formed. But now we are inclined to believe that the movement of the nebula had a good deal to do with the formation of the solar system.

Men used to think that space outside it was quite empty as far as the nearest of the fixed stars, but we are now learning that space is very far from empty, and that really it is swarming with those little bodies like grains of sand or pebbles, or even larger bodies still, which we have already described as being found within the solar system. It is quite reasonable to suppose, then, that as the nebula went through space, gradually becoming smaller and denser by the force of gravitation causing it to shrink, it would come across millions and millions of these grains and pebbles, also rapidly moving.

THE EARTH OF LONG AGO THAT WAS LIKE THE SUN TO-DAY

Many interesting consequences would follow. If the nebula ran across a great swarm of meteorites, as the earth does in November, then there might be the beginnings of a planet. But even apart from such a swarm, there would be marked results from the millions of little collisions that would be constantly happening. For one thing, the nebula would be made hotter, for when anything in moving strikes anything else, or is partly stopped by it, its motion is turned into heat, which is itself a kind of motion. We use this fact every time we strike a match. We put the match in motion and then partly arrest the motion by whatever we rub it against; so there is enough heat produced to set the match on fire.

That, then, is all that we can tell at present about the origin of the sun and its family. Everyone is agreed that something like this is what really happened. Now let us try to imagine what our own earth must have been like in its beginnings. We cannot be quite certain as to the shape of the earth at first, though some men who have made a careful study of the subject think it may have been shaped like a pear instead of like a flattened orange, as now.

We think of the earth as something that ends suddenly at the surface—at the level of the ground. That is, however, by no means quite correct. Even now as an orange does. We must not imagine that the earth ends at the level of the ground or at the level of the water, and that we walk outside it.

THE SOLID EARTH THAT THINS OUT UNTIL IT IS A GAS

Not at all. Above both the ground and the water there is something which is really part of the earth, though we cannot see it. It moves with the earth round the sun and twists round with the earth as it spins. The stuff of which it is made is constantly being exchanged in both directions with the water of the sea and the stuff of which the dry ground is made. In short, the air is part of the earth. The air as it is at present probably extends upward from the surface of the solid and liquid part of the earth to a distance of about a hundred miles. As we pass upward through the air in an airplane we find the air becoming more and more thin, or more and more *rare;* and though we cannot go very far, we are quite sure this rareness goes on increasing until there is no air to be found.

So even now, we see, the earth does not really stop short sharply anywhere, but its stuff is spread out all round it in a layer of gas which gradually becomes rarer and rarer until it stops altogether.

WHAT THE GREAT FRENCHMAN LAPLACE TAUGHT

According to scientists who believe the theory of Laplace, what we now call the earth was at first nothing more nor less than a great globe of glowing gas. In that hot, twisting, glowing globe there were contained all the tiny little portions of matter, or atoms, which now make up the water of the sea, the soil, the rocks, the bodies even of all living things, and also, of course, the air, or mixture of gases, that still remains covering the earth like a warm blanket.

So far are we from being really on the surface of the earth that the whole world, sea and land together, is really covered with a great sea or ocean of air. We crawl about at the bottom of this ocean, and one of the latest things that men have learned to do is to jump off the bottom and swim in it, as birds have been able to do for ages without troubling their heads at all; only we call this *flying.*

In the course of time we know that great changes had to happen in this glowing globe. It is possible that for a time

it gave out light and heat like a little sun. In doing so it would gradually become cooler. If you make a poker red-hot, and then take it out of the fire, it will give out light and heat for some time; then it will give out heat only, but no light—it is still hot, but will have become dark; and it will become quite cold. It cannot give out light and heat without becoming cooler, for it does not make them out of nothing. The case may have been the same with the earth, and in the course of long ages it had gradually to become cooler. At last it had to become so cool that part of the stuff of which it was made would no longer remain a gas, but became a liquid.

How the Earth Cooled Outside While the Core Was Red-Hot

Now, that part of the earth which would soonest become cooled would not, of course, be the hot inside, but would be the part next to the surface. All the kinds of stuff that were most apt to become liquid would become so, and, being heavier, would fall toward the centre; while the kind of stuff like the air of to-day would stay where it was. So we can imagine an earth with a core of hot gas and a layer of liquid outside that, and then a layer of cool gas, or air, outside that. But soon even part of the stuff that had become liquid would become solid, or perhaps like a thick oil.

It must be remembered that all this time the earth was twisting round and round like a top, as it has done ever since. Also it must be remembered that the great sun is all this time pulling as hard as it can upon the earth by means of gravitation. We can imagine, then, that the liquid stuff next to the sun at any given moment would be apt to be pulled out toward the sun or heaped up at the surface of the earth. But, of course, as one point of the earth is never opposite the sun for long, this heaping-up of the liquid on the surface would be like a wave traveling over the surface of the earth. Now this great traveling wave is nothing else than a *tide*, and every child who has been to the sea has seen its consequences. But if what we have said is true, the first tides that were raised by the sun upon the earth were not tides of cold water; the earth was too hot for that, and all the water in it was in the form of a gas in the air, like the water in your warm breath before it strikes the cold window-pane.

The Way the Beds of the Oceans May Have Been Made

The first tides that rolled upon the earth may have been terrible tides made of stuff like red-hot lava—the red-hot stuff that comes out of a volcano and runs down in fiery streams until at last it turns quite cold and solid.

A very remarkable thing happened somewhere about this time, according to this theory. Some men believe that one day, while these tides of lava were rolling round the earth as it spun, part of the stuff was whisked off like drops from a wet umbrella when you spin it. This became the moon. Perhaps at this time the surface of the earth had become cool enough for the great gaps left by this loss to remain more or less fixed, and some people think that those gaps are now the basins of the seas.

The Planetesimal Theory of the Beginning of the Earth

The theory of Laplace does not answer all questions, and so many astronomers have tried to find other explanations. We can tell only one of them. This is the planetesimal (little planet) theory of Professors Chamberlin and Moulton of the University of Chicago which is now believed by many scientists.

This theory also starts with a nebula which had a central portion, and two arms, with many knots such as we see in the pictures of nebulæ to-day. The central mass became the sun, the larger knots became the planets, and the smaller knots nearer the larger ones became the satellites, or moons, of the planets. The scattered material (planetesimals) was attracted to the sun and the planets, or else collided with them and was joined to them. So for a long time all of them grew larger, until the most of the planetesimals had been joined. The earth was not so hot at first as it became later. The interior became heated through weight and compression, and perhaps because of radium and similar substances. This heat escaped through volcanoes and in other ways. When the mass became great enough, it captured gases which became air and water. The moon was not thrown off from the earth, but developed along with it. We cannot stop now to give the reasons for these differences, and they make little difference in our daily life.

THE NEXT STORY OF THE EARTH IS ON PAGE 235.

THE THREE LITTLE PIGS

CONTINUED FROM 60

ONCE upon a time three little pigs went out into the world to seek their fortunes. The first little pig had not gone far before he met a man who was carrying a bundle of straw.

"If you please," said the little pig, "will you give me some of that straw to make me a house?"

"With pleasure," replied the man, and away went the little pig with the straw and built his house.

Now, an artful old wolf who lived near by determined to have the little pig for supper. So when it became dusk he went up to the little straw house and called out: "Little pig, little pig, may I come in?"

But the little pig knew his voice and said: "No, no; by the hair on my chinny, chin, chin!"

"Ho, ho!" cried the wolf. "Then I'll puff and I'll blow till I blow your house in."

So he puffed and he blew, and he puffed and he blew till the house fell down. Then he sprang inside, pounced on the little pig and gobbled him all up.

The second little pig met a man carrying some sticks.

"If you please," said the little pig, "will you give me some of those sticks to make me a house?"

"With pleasure," replied the man.

Away went the little pig with the sticks and built himself a cozy house.

That night the wolf came to the door.

"Little pig, little pig," cried the wolf, "may I come in?"

"No, no," replied this little pig, as the other one had done; "no, no; by the hair on my chinny, chin, chin!"

"Ho, ho!" cried the wolf in a rage. "Then I'll puff and I'll blow till I blow your house in."

So he puffed and he blew, and he puffed and he blew till the house fell down. Then he sprang inside, pounced on the poor little pig and gobbled him all up.

But the third little pig was exceedingly wide awake the morning *he* set out on his travels. This little pig went on till he saw a man carrying bricks.

"If you please," said the little pig, "will you give me some of those bricks to make me a house?"

"With pleasure," replied the man, and away went the little pig with the bricks and built his house.

Soon the old wolf came along that way and knocked at the door.

"Little pig, little pig, may I come in?" he cried.

"No, no," cried the little pig; "no, no; by the hair on my chinny, chin, chin!"

"Then I'll puff and I'll blow till I blow your house in!"

But the house was made of bricks, and the old wolf he puffed and he blew, and he puffed and he blew, and still

the house stood firm. At last he went away in a rage; but presently he came back again.

"Little pig, little pig, I know a field just down the lane where there are such fine turnips. I'll call for you in the morning and show you the way."

The next morning when the wolf called out: "Are you ready, little pig?" the little pig replied: "Dear me, how late you are! I've been back an hour or more. I'm sure I'm much obliged to you; they are fine turnips!"

The wolf was furious; but, pretending he did not mind, he said, quite pleasantly: "Do you like apples? I know an orchard down the lane where the trees are covered with fruit. I'll call for you in the morning and show you the way."

The next morning the wolf got up very early and walked round to the little pig's house. But the little pig must have got up earlier still, for he was not at home.

The wolf hurried off to the orchard; but the little pig saw him coming and climbed up into a tree.

"These are indeed fine apples," he called out, as the wolf came up to it. "Just try this one." And he threw the apple as far away as he could into some long grass. Then, while the wolf was hunting for it, the little pig scrambled down the tree and ran home.

The wolf did not like being beaten, so the next morning he went again to the little pig's house and said: "Little pig, little pig, there's going to be a fair on the village green this afternoon. You come along with me, and we'll both have a fine time. I'll call for you at exactly three o'clock."

The little pig said nothing, but at half-past two he started off for the fair. He bought a churn, and was rolling it home when he saw the wolf in the distance. Quick as lightning the little pig jumped into the churn to hide, and set it rolling down the hill. The hill was steep, and the churn came flying along at such a speed that the wolf became frightened, so he turned back and ran home as fast as he could.

Some hours later, when he felt braver, he went to the little pig's house.

"I was just on my way to call for you this afternoon," he shouted out, "when I met the most awful thing rolling down the hill all by itself. It gave me a horrible fright, I assure you. There must have been a witch inside."

The little pig burst out laughing, and he laughed so loud and he laughed so long that the old wolf was annoyed.

"I was the old witch," said the little pig, as soon as he could speak. "I spied you a long way off, and I jumped inside to save my skin."

This so enraged the wolf that he jumped up on to the roof and began sliding down the chimney. But it was baking day, and the little pig had made a huge fire. Down, down, down slid the wolf; there was nothing to save him. He fell right down into the fire and was burned to cinders. And that was the end of the wolf.

THE DOG THAT REMEMBERED ODYSSEUS

WE have read some stories about the hero Odysseus, who is sometimes called Ulysses; and this is the story of his dog, whose name was Argus. Before Odysseus went away from his home in Ithaca to the great war with the Trojans there was a puppy born, which grew to be a noble hound.

Odysseus loved Argus, and Argus loved his master. The hound would prick up his ears and give a joyful bark when his master approached. Then he would look at Odysseus with a world of love reflected in his eyes, and raise his head for the caress which always followed.

As Argus grew older he seldom left Odysseus for long. Like a shadow, he followed his master everywhere, except upon very long journeys. But before the hound was fully grown, Odysseus went away to the war, which lasted for ten years. And still a long time passed, and Odysseus had many wanderings before he came again to Ithaca. And when he returned, being worn and travel-stained, there was no one who knew him again.

But when he came to the palace, there lay at the gate the ancient hound Argus, very near death. Yet when the hound looked upon Odysseus and heard his voice, he lifted his head and feebly wagged his tail. But more than that he could not do, for death came upon him there in the hour of his joy at the sight of his old master, whom none but he, the faithful companion, had recognized.

THE LITTLE PRINCES IN THE TOWER

TOWARD the end of the fifteenth century a little cavalcade set out from Ludlow Castle for London. The centre of this party was a handsome boy thirteen years of age. News of his father's death had reached the castle, and as his father was Edward IV, king of England, the little boy set out as soon as possible, with his gentlemen about him, to claim his kingdom.

On the way the party was met by Richard, Duke of Gloucester, a small, misshapen man, with cunning, cruel eyes and a harsh tongue. This Duke of Gloucester was the younger brother of the dead king and an uncle of the handsome boy riding to claim his kingdom. He explained that he was now regent of England, because the new king was only a boy, and accusing the gentlemen who rode with little Edward V of treason, he had them arrested, and himself took charge of the boy-king.

The boy cried bitterly when his friends were taken from him, for he feared his ugly uncle and hated to go with him to London. But the Duke of Gloucester pretended to be a kind uncle, and told the little king not to fear. He had him carried to the Tower of London, where the boy was to lodge until the affairs of his kingdom were settled. But when the door of the Tower closed upon him, the poor little boy-king knew that he was a prisoner.

The queen, when she heard what the Duke of Gloucester had done, fled in terror with her second son, whose name was Richard, to Westminster Abbey. She felt sure that some evil would befall her elder son, and determined to save her second son from the wickedness of the ugly uncle.

Now, this brutal man, Richard, Duke of Gloucester, had the black heart of a murderer. The young princes, Edward in the Tower of London and Richard with his mother in Westminster Abbey, were not fine boys in his eyes, but only hateful obstacles to his great ambition.

He wanted to be, not regent, but king of England. Between him and that ambition were the warm young bodies and the fresh young lives of these two pretty children. To slay those fair bodies and send those two innocent souls into eternity became his master-passion.

How did he accomplish this end?

He first sent a kind bishop to the queen in Westminster Abbey, saying that the little king in the Tower longed for his brother to play with him, and begged her that the boy might be sent thither. Most reluctantly the poor queen gave up her second son; and the two little brothers clasped each other in the Tower of London, and wondered what would become of them. They were both very much frightened, very lonely and very sorrowful.

Then the Duke of Gloucester spread the wicked lie that these young princes were not the sons of the dead king. He hoped that the people would cry out: "Long live King Richard!" but there was no shout for this evil man. He cut off the heads of all those true noblemen who stood by the queen, and gathered about him a weak party who declared that he was the rightful king. People were actually paid to go about saying that the Duke of Gloucester should be king.

At last, in defiance of the whole nation, the duke was crowned king of England, while the true boy-king remained a prisoner in the Tower. If the nation had risen, as it should have risen, and had cried that Edward V was their king, Richard would have been saved one of the foulest deeds in history. He could not rest. He was the king. He was Richard III. He wore the crown. His word was absolute. His power none could dispute. But the little boys still lived.

He was troubled by the thought of those two poor, miserable children shut up in the Tower and frightened by their own shadows. They poisoned his happiness and kept him jealous and afraid. While they lived he was a robber. He determined to be a murderer.

One day he could bear the thought no longer. He sent to the governor of the Tower, telling him that the princes were to be killed. The governor refused to execute this abominable command.

Then the king sent another messenger, bidding the governor deliver up the keys of the Tower for one night. This the governor was obliged to do.

That night two murderers approached the Tower, and opened the doors with the keys given them by the king. They

made a hole in the stone floor under the staircase, and then, sweating from their labor, ascended the stairs. They reached the door of the room where the young princes slept. They stood for a moment to gain their breath. Then, very quietly, they turned the key in the lock, and stole into the room on tiptoe. The only sound was the breathing of the sleepers.

The two beautiful prisoners lay in each other's arms on the big bed. Their curls lay spread upon the pillows. Their cheeks were flushed by troubled dreams. Their eyelashes were wet with tears. They had fallen asleep cuddled close together in that companionship of fear which possessed them every day, and still more in the dark hours of the night. Nothing could have been lovelier or more holy than the sight of those two sleeping defenseless children.

The murderers looked for a moment at the sleeping princes—one of them the rightful king of England—and then turned hastily away lest the beautiful sight of that pure and innocent sleep should rob even their hearts of intent toward this foul deed. Then they laid sudden hold upon the bedclothes and the pillows, wrenched them off, and crammed them over the heads of the startled and awakening children.

As the poor children roused, the murderers pressed the weight of their bodies on the suffocating load, and forced the pillows hard against the mouths of the boys. A little cry; a convulsive struggle of the two poor little bodies; then a long and feeble twitching of the limbs—and the murderers felt, under the clothes, the bodies of their victims lie still forever. The prisoners were set free. The hard-breathing murderers drew away the clothes, and saw that the princes were dead. They gathered in their arms the dead bodies, still warm with departed life, and carried them out of the room and down the narrow stairs.

In the hole which they had dug they threw the bodies, and covered them with broken stones and earth, and trod the place flat. Then they went out of the Tower, and passed into the peaceful night, with the stars above their heads, and the Thames making music in their ears.

Richard III was king.

"GOOD LOSERS"

THE Spanish soldiers who capitulated at Santiago on the sixteenth of July, 1898, requested, with General Shafter's permission, to be allowed to send their good wishes and farewell to the courageous and noble soldiers under his command, and inclosed the following letter of gratitude:

Soldiers of the American Army:

We should not be fulfilling our duty as well-born men, in whose breasts there live gratitude and courtesy, should we embark for our beloved Spain without sending to you our most cordial and sincere good wishes and farewell. We fought you with ardor, with all our strength, endeavoring to gain the victory, but without the slightest rancor or hate toward the American nation. We have been vanquished by you (so our generals and chiefs judged in signing the capitulation), but our surrender, and the bloody battles preceding it, have left in our souls no place for resentment against the men who fought us nobly and valiantly. You fought and acted in compliance with the same call of duty as we, for we all but represent the power of our respective states.

You fought us as men, face to face, with great courage, as before stated. You have complied exactly with all the laws and usages of war, as recognized by the armies of the most civilized nations of the world; have given honorable burial to the dead of the vanquished; have cured their wounded with great humanity; have respected and cared for your prisoners and their comfort, and lastly, to us, whose condition was terrible, you have given freely of food, of your stock of medicines, and you have honored us with distinction and courtesy, for after the fighting the two armies mingled with the utmost harmony.

With this high sentiment of appreciation from us all, there remains but to express our farewell, and with the greatest sincerity we wish you all happiness and health in this land, which will no longer belong to our dear Spain, but will be yours who have conquered it.

From 11,000 Spanish soldiers,

PEDRO LOPEZ DE CASTILLO,
Soldier of Infantry.

TWO BOYS WHO WERE BORN TO BE KINGS

Terrified and lonely, and closely guarded in the Tower of London, these boys wandered over 400 years ago. One is Edward V, the rightful king of England, and the other is his younger brother, Richard, who would have followed him on the throne if he had lived. Their wicked uncle, the Duke of Gloucester, imprisoned them, and afterward had them secretly murdered in order that he might become king.

THE BOY WHOM FRANCE FORGOT

A LITTLE over a hundred years ago a boy was born in the Palace of the Tuileries who seemed to be destined to rule over a great empire. His father was Napoleon Bonaparte, emperor of the French, a man whose name was a terror to all Europe. His mother was the empress Marie Louise, a daughter of the emperor of Austria, whom Napoleon had married as his second wife after he had divorced the empress Josephine. The baby's birth on the twentieth of March, 1811, was announced by the roaring salute of many guns; his coming was a great joy to the French nation as well as to his parents. He was given the title of King of Rome, and his christening was a stately ceremony at the Cathedral of Notre Dame. It seemed as though he had a great future before him, and yet he grew up without a mother's love or a father's care. His short life was pitifully lonely. His early death was a relief to most of the people who thought of his existence at all, and his name is scarcely mentioned in the histories.

Francis Joseph Charles Bonaparte was born when it seemed to the world that Napoleon was at the height of his power, and everyone thought that the King of Rome, as his baby son was called, was sure to succeed him on the throne of France. When the little boy was only two and a half years old his education was begun, and he was given lessons almost before his baby lips could repeat the words that were taught him. His father was determined that he should be well prepared for the great place he was to fill. But before the prince was three years old, Napoleon had been defeated by the bitter cold of the Russian winter. All the countries in Europe had combined against him. He had fought and lost the great Battle of the Nations at Leipzig. Even then he might have kept his throne if he had promised to be content with the kingdom of France, but this he refused to do and everything was taken from him. As the armies of the allies who had defeated the emperor neared Paris, Marie Louise fled from the city, taking the King of Rome with her, and Napoleon never again saw the son of whom he was so proud and whom he loved so dearly.

The emperor was sent into exile on the little island of Elba in the Mediterranean. Marie Louise, who did not care for her husband, made no effort to go to him, and was quite content to obey her father's command that she should give him up. She agreed, too, to give up the title of empress, and was made Duchess of Parma and two other small Italian states. The title of King of Rome was taken from her son, and it was agreed that he was to succeed his mother as Duke of Parma.

This was in 1814, and the next year it seemed for a time as if he might be emperor of the French after all. Napoleon escaped from Elba, and gathering a great army as he went, marched through France to Paris and turned out Louis XVIII, the Bourbon king whom the allies had placed on the throne. But the emperor's second reign lasted so short a time that it is called the Hundred Days. Waterloo put an end to it forever, and lost for his son even his small dukedom. For after Napoleon had been banished to St. Helena, the little boy was given the title of Duke of Reichstadt by his grandfather, and it was decided that he should never rule.

By this time Marie Louise had gone to live in her duchy of Parma, but she did not take the duke with her. From this time onward he became a pawn in the game of European politics. Sometimes the great Austrian minister Metternich put forward his claims, at others the malcontents in Italy and in France used his name to stir up trouble. These efforts only made the great powers of Europe the more determined that no son of Napoleon should ever rule, and in November, 1816, Marie Louise was informed that her son could not succeed to the duchy of Parma. As he was not to succeed her, it was thought better that he should be left in Vienna with his grandfather, who undertook his education. He was to be brought up as an Austrian subject, instead of a French prince, and so all his French attendants were sent away, except his nurse, and she soon went. He was placed in the care of an Austrian gentleman named Count Dietrichstein, who was called his governor, and he was still so young that it was hoped that once he was surrounded by Germans, he would forget all he had been told about his father. But he never did. Perhaps he had some faint recollec-

tion of the man who played with him in the old days in France. He certainly remembered the stories his nurses had told of his father's greatness, and loved his memory, and liked to think of him.

His many tutors found him a difficult pupil, especially at first. He was very obstinate, and as he did not wish to speak German, there were many outbursts of temper to be subdued. Happily, however, he became much attached to Count Dietrichstein, who was very kind to him and treated him with great wisdom. This was all the more fortunate, as his mother married again, after his father's death, and from that time onward he saw little of her.

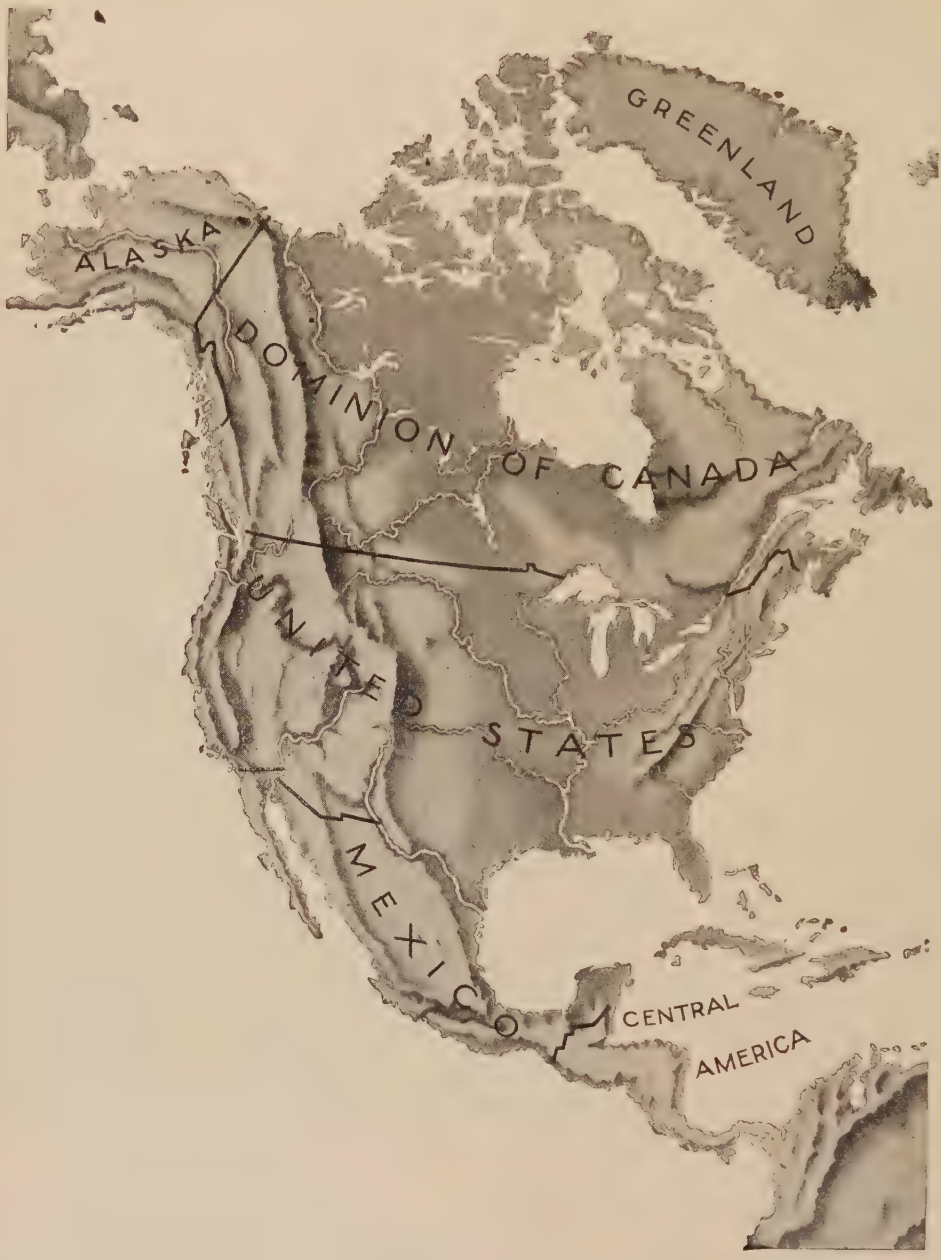
He admired his father so much that he was delighted when he learned that his grandfather wished him to become a soldier. It was a great day for him when he got his first uniform, though he was only made a corporal, for his tutors thought it better that he should be advanced slowly. He was a clever boy, but lazy, and promotion was held out as a reward for diligence in his studies. No pains were spared to provide him with good teachers and to train him to be not only a good soldier but a great man.

He was carefully taught his profession, and all the soldiers looked forward to the time when he would command them, and perhaps lead them to victory. But their hopes were not to be realized, for already his days were numbered. In the spring of 1832 he fell ill, and in July he died. When the news of his death was heard in France it caused but a ripple of interest.

NAPOLEON'S SON, THE CHILD KING OF ROME, WHOM FRANCE FORGOT

THE NEXT STORIES ARE ON PAGE 397.

THE SURFACE OF NORTH AMERICA



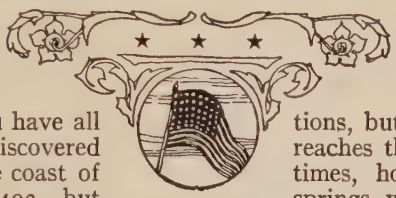
This map of North America shows the land itself with its streams and mountains. You can recognize the great slopes of which you are told. Notice the narrow slope down to the Atlantic Ocean, the great trough in the centre, the Rocky Mountains, the great highland west of them, and then the Coast Ranges. You can understand from this map how far down the ice sheet came, and how far up into the land the Gulf of Mexico once reached. You can see also how like and yet how unlike the United States is the surface of Canada and of Mexico. A study of the surfaces of a country helps one very much to understand its settlement and its history.

From the Natural Introductory Geography, copyright 1897, 1907, by the American Book Company.

THE GREAT CONTINENT OF NORTH AMERICA

IN this story and those that come after we shall tell you the story of North America from the earliest times of which we know anything down to the present. If you read them carefully the editors hope that you will not find them dull and that you will find many things that you will be glad to know. In this story we shall learn what part of the land first rose from the sea, and something of the plants and animals that lived in the old days. We shall learn that a great part of the continent was once covered with a sheet of ice over a mile thick, and we shall be told what it did. Then we shall learn something about the strange men that the white men found when they came.

NORTH AMERICA BEFORE WHITE MEN



HAVE you ever thought about North America before there were any white men here? You have all heard that Columbus discovered a little island near the coast of North America in 1492, but that is only something more than four hundred years ago, while the land itself is millions and millions of years old. You all know something of your country and are proud of it. You have heard your father say that someone was a good citizen and you knew it meant something pleasant. You boys and girls also want to be good citizens. Now, in order to be good citizens, you must know something about the great country in which you live, for an ignorant man cannot be a very good citizen. Citizens have something to say about how they are governed and unless you know something about what has happened in the past, how can you tell what is best now?

Now look at the rather queer map which is printed with this article. On it towns, cities, railroads and other works of man are not shown at all, but only mountains, rivers and plains, all the work of nature. This is called a relief map, and is interesting for many reasons. As you read more widely, you will learn how mountains and valleys affect rainfall and climate, and upon these two men's success upon the earth depends. In a climate which is too hot or too cold, too wet or too dry, men cannot work well.

Rivers and smaller streams, even in the same neighborhood, run in different directions, but their water generally reaches the same place. Sometimes, however, the water of springs which are only a few yards apart finally enters the sea hundreds, or even thousands, of miles apart. In the Canadian Rockies there is a place where, as you see, three rivers rise not very far apart. One flows into the Pacific, another into the Arctic, and the third into Hudson Bay.

Perhaps some of you have been to Asheville among the mountains of western North Carolina. If so, you remember that the train stops just after it comes out of a long tunnel through a mountain, and beside the railroad you will see a little spring tumbling down the mountain side. Throw some bits of paper into the stream and watch them. Soon the stream divides, some of the paper is carried east and some is carried west. The water that flows west will finally reach the Gulf of Mexico, while the other little stream finally reaches the Atlantic Ocean.

THE GREAT DIVISIONS OF NORTH AMERICA

The continent has only four great slopes, one toward the Atlantic, one toward Hudson Bay and the Arctic Ocean, one toward the Gulf of Mexico, and one toward the Pacific Ocean. Land also slopes toward the Great Lakes,

but they empty into the St. Lawrence River and this great river flows into the Atlantic Ocean. All the land in any one of these slopes is not alike, and the climate and the soil also may differ very much, but still all these are generally more alike than they are in the other great divisions.

Suppose we could fly in a gigantic aeroplane from the Atlantic to the Pacific, what should we see?

While what we should see depends somewhat upon where we start, the general features are much alike. Suppose we start about the middle of the continent. First, there is a stretch of low land raised only a few feet above the level of the sea. This is broadest toward the southern part of the United States. In many places there are many streams which flow very slowly. Sometimes, in fact, they seem to flow away from the sea instead of into it, as the tides from the ocean rush in and push the stream back. This stretch of land is called the Coastal or the Atlantic Plain. Going further west, we see below us hills and valleys through which the streams flow quite rapidly. In many of the streams are waterfalls, when the streams suddenly drop from a higher to a lower level. In the United States this region is called the Piedmont Plateau. (The word "Piedmont" means "at the foot of the mountains.")

THE HIGHEST MOUNTAINS IN EASTERN NORTH AMERICA

Sailing steadily westward, we find that our machine must rise higher in the air, for we are coming to mountains covered with forests. These mountains are not so high as some we shall see farther to the west, but still many points are more than a mile high. The best known are Mt. Washington in New Hampshire, 6,293 feet high, and Mt. Mitchell in North Carolina, 6,711 feet high. Perhaps there are some others quite as high in Labrador which have not been measured. These mountains do not extend into Mexico, but here are to be found many rich mines of coal and iron.

Crossing these mountains, we again see hills and then the wide St. Lawrence and next the Great Lakes, real inland seas, but soon we reach the level prairie region, in which are fertile farms. There are fields of wheat which extend for miles. If we look to the south we see many fields of corn also. We see herds of fat cattle and many pigs which will give us beef and bacon. This is one of the finest farming regions in the world, but it has many cities also. Perhaps to the south of us we can see the mighty Mississippi River, one of the greatest rivers in the whole world. To the north is Hudson Bay, a vast irregular sheet of water.

Beyond are the same plains with their fertile farms, but finally the ground begins to rise again. The land no longer seems so green, farms are fewer, but we may see cattle wandering about grazing on the short grass. At length we come to a region which is called the Cordilleran Highland. First there are the Rocky Mountains on the east, then a high, rocky region with many irregular mountains, and the low Coast Ranges still farther to the west. These mountains extend into Mexico, as you see from the map. Some of these mountains are very high. In the state of Colorado are thirty peaks, each of which is more than two and a half miles above the level of the sea. Further north are Mt. Logan (19,540 feet), Mt. St. Elias (18,000 feet) and Mt. McKinley (20,300 feet). Through this region are rich mines of gold and silver, and other metals hardly less valuable. Then the country slopes down to the Pacific Ocean in a region of abundant rainfall where farming of every sort flourishes.

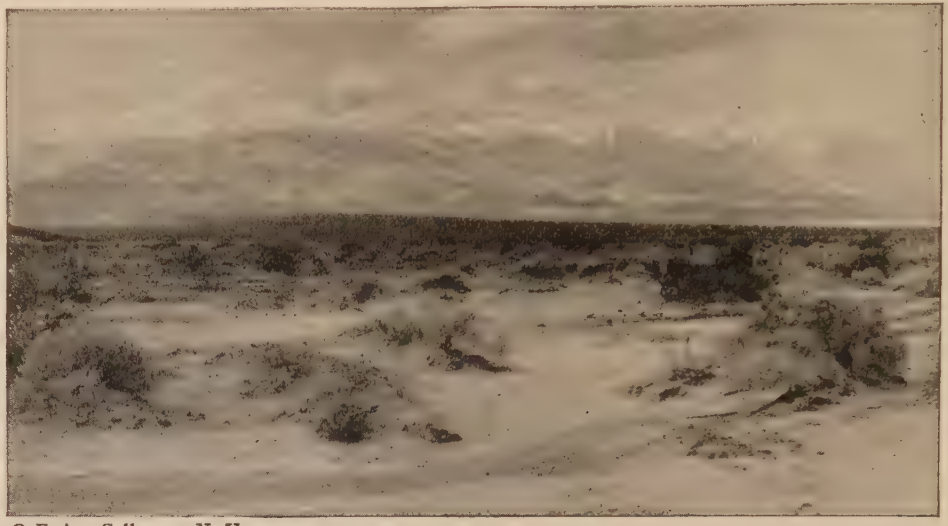
If we were to cross the land further north or further south, we should not find exactly the same sort of land, occupations or people. For example, further north, in addition to the mountains, we should pass over thousands of lakes, some large, some very small. We see hundreds of factories and many cities in the eastern half of the continent. If we crossed much further south, there would be fewer lakes, fewer cities and fewer factories, but we should find cotton, sugar cane and oranges growing, and we should find almost no hills at all until we reached the Far West. Somewhere in North America we can find almost every kind of soil, climate and product. Plants which belong to the Arctic Zone grow not only in northern Canada, but in the high mountains of New England; and in some parts of Florida, California, Louisiana and Mexico the summer lasts the whole year round. Some of the continent is wet and swampy all the time, but another part is a real desert. However, both swamps and desert are

Photo S. J. Hayward.

Cape Trinity, so named because of its three steps, stands 1,600 feet above the river. On the opposite shore is Cape Eternity, higher still. They form part of the noble scenery of the Saguenay River in Quebec.

Courtesy Canadian Pacific Railway.

The Selkirk Range contains some of the most wonderful mountain scenery in the world, and no part of it is more fascinating than the Illecillewaet Valley, below the great glacier of that name. The picture shows the glacier upon the side of Mount Sir Donald, which was named for Sir Donald Smith, later Lord Strathcona.



© Ewing Galloway, N. Y.

This is Death Valley, California, the driest and hottest place in the world. It is 276 feet below sea level, 150 miles long and fifteen to twenty wide. The mountains are nearly 11,000 feet high. Little rain falls and the temperature is often 125° in the shade for days in succession. Dew never forms there.

© Underwood & Underwood, N. Y.

Much of Southern Florida is a great swamp called the Everglades, which has not yet been drained, or even entirely explored. Vegetation is very luxuriant, as the rainfall is abundant, and the climate warm and moist, and the soil very rich. Snakes, alligators and other unpleasant things are found.

growing smaller, for men are draining the swamps and bringing water to the desert.

THE SURFACE OF NORTH AMERICA MANY, MANY YEARS AGO

As you will see, there is no natural boundary between Canada and the United States for the greater part of the distance. The St. Lawrence and the Great Lakes form a part of the boundary, but there is not really very much difference between the land on either side of this boundary. The heavy black line is a boundary drawn by men, and you cannot tell by the land itself when you go from one country into the other, or when you go from Canada into Alaska. The boundary between Mexico and the United States is partly a line, and partly the Rio Grande, or Great River.

Such is North America to-day, but it was not always so. The wise men tell us that millions of years ago waters covered the whole face of the land. Then the crust crumpled and folded as you may read in The Book of the Earth. It is believed that the northeastern part of Canada, from Labrador to the Arctic Ocean, including Hudson Bay, was the first land to appear. About the same time chains of islands in the eastern and western parts of the continent appeared. These were the tops of high mountains, which have long since been worn away. As the years went on, other land was raised above the sea, but still the Gulf of Mexico reached up about to the point where the Ohio flows into the Mississippi, and further west probably extended into Canada. On the other hand, the bed of Hudson Bay was once probably dry land, which afterward sank and let in the waters of the sea.

HOW DO MEN KNOW ALL THESE STRANGE THINGS?

We cannot be sure of all of these things which we are telling you. Man was not on the earth then, but the geologists study the rocks, the marks left upon the rocks, the soil, the flow of streams and many other things, and they say they are certain of some things, and that their explanations of others seem to be true. We cannot tell you all that these students believe about the history of the continent, as it would require all of The Book of Knowledge. They believe that many parts were raised and lowered several times, that the continent was once much larger than it is now, as well as much smaller, at different times, and that the climate was very different at different times.

In the Scarboro Cliffs and the Don valley near Toronto a wonderful story is written. Here material settled during hundreds of years, and the students of the earth read the record like a book. These wise men say that they find the remains of many plants which can grow only in a warm climate in the lower part, and above these are signs of plants and animals which belong to a climate like that of Labrador. They believe also that the climate grew colder still before it became warmer again.

We have proof that for many years plants grew and died in great swamps in different parts of the continent, until their decay made beds of vegetable matter many feet thick. These beds of vegetable matter which are now coal show that the climate of Alaska and Nova Scotia, for example, must have been moister and probably warmer than that of Louisiana to-day. Wherever you find coal you know that the place where it is found was once low, marshy and warm, for perhaps thousands of years. In the third volume you are shown a coal-mine.

HOW THE COAL-FIELDS WERE MADE LONG AGO

The level of the land changed, and these beds of dead trees and ferns sank into the sea or into the great inland lakes, and were covered with mud many feet thick. Again they were raised, and in this mud the same sort of plants again grew and decayed, and the mud was covered with many feet of black mold. Hundreds of years later they were again below the level of the water. In some parts of the country the land was raised and then lowered in turn for thousands and thousands of years, and the layers of vegetation because of the great weight and heat became coal, and the layers of sand and mud became rock. In some parts of the continent there are many beds of coal one above the other with layers of rock between them.

The land is still changing to-day. The sea tears away some coasts and builds up others. The rivers cut away their banks, and hills and mountains are being worn away. But other changes, more important than these, are also taking place. Some of the western mountains seem to be slowly rising. Men who study such things tell

us that the coast of New Jersey is sinking about two feet in a hundred years, and that some day the land where towns and farms now stand will again be under the sea. The land in Canada toward Hudson Bay is said to be rising, and some day, hundreds or thousands of years from now, the water in the Great Lakes may possibly find its way into the Mississippi, as it did long ago.

VOLCANOES ONCE WERE COMMON IN THE WEST

The mountains which were raised above the sea began at once to wear away because of the action of water and air, heat and cold. Wise men tell us that some parts of the eastern mountains were once at least five miles higher than they are now. The western mountains are younger and have not worn away so much. In the West, too, in both Canada and the United States, are many mountain peaks which are dead volcanoes, though some may be only sleeping. Mt. Hood in Oregon and Mt. Shasta in California are fine examples of dead volcanoes. In Alaska, Mexico and Central America there are today live volcanoes, which throw out ashes. As the lava decays, it sometimes makes a very fertile soil, and this is one of the reasons why some of the western lands grow such wonderful crops.

SOME ANIMALS WHICH ONCE LIVED IN AMERICA

Queer animals once lived in the country. Some were larger than any animals now alive. On page 91 you may read about them. There were flying lizards, and lizards that walked. Much later there were great animals, like elephants, great rhinoceroses, camels and fierce tigers with long teeth roaming the country. The mammoth and the mastodon, great elephant-like creatures, which are described in another place, towered above the other animals. Skeletons have been found in both Canada and the United States. A skeleton of a mastodon, found in the Hudson Valley, showed that the animal had sunk in a swamp many thousands of years ago. In his mouth were some twigs which he had been chewing when the ground gave way beneath him. There were also huge buffalo with horns ten feet from tip to tip, and great elk.

THE VERY COLD TIME WHEN ICE COVERED THE LAND

Thousands and thousands of years passed with changes of climate. Once it had been much warmer than it is now. It became much colder. The continent was larger than it is now, since much land that is now under sea was then high above the water. Many of the islands were joined to the mainland. The climate became so cold that great ice sheets, called glaciers, covered most of Canada and much of the northern part of the United States. You learn the causes of glaciers in another part of our book, and so we shall tell only a little of what these did. The ice sheets were several miles thick in some places and covered all of New England and New York, except a little corner, much of New Jersey and Pennsylvania, and in the Mississippi Valley crossed the Ohio River at one place. In the western part of the United States they did not go down quite so far. The glaciers moved slowly, scooping off the soil, gouging out rock, cutting off the tops of the mountains and carrying with them great heaps of earth and gravel, which they left as the ice melted away. These heaps are called "moraines," and are still to be seen in many parts of the land, though they are often covered with farms or trees now.

Much of Long Island was deposited there by the glaciers. The same may be said of Cape Cod, which some of our readers know is a delightful place to spend the summer. The island of Martha's Vineyard is a moraine deposited there ages ago, and the same is true of the other islands near by.

Someone has said that the glacier was a combination of a huge file, a great plow and a mammoth dump-cart. The scratches and grooves made by the rubbing of great rocks upon each other can be yet seen, and many of the huge boulders lying in the fields were brought from hill-tops hundreds of miles away, and, as the ice melted, were dropped where they now lie. Some are so delicately balanced that a child can move them, though they weigh many tons.

HOW THE ICE SHEET MADE THE LAKES WE LIKE SO MUCH

Another effect of this great ice sheet was to make most of the beautiful lakes in the northern part of the continent. If you look at a map you will see that there are very few lakes in the southern part, while there are thousands in the north. Nearly all of these are the work of the great glaciers which covered the land. Even the Great Lakes, Superior,

Huron, Michigan, Erie and Ontario, are due to this cause, and so is Long Island Sound.

Lake Winnipeg is one of the most interesting of these lakes. It was once much larger than it is now and covered much of Manitoba, some of Ontario and Saskatchewan, and even extended far down into the United States. The city of Winnipeg is in the old lake bed. For a long time it emptied southward into the Minnesota River and then into the Hudson. Later the ice sheet went back and allowed it to drain into Hudson Bay and also to become smaller.

These lakes were made in three ways. Sometimes the ice sheet dumped great masses of the rock dust upon the land, leaving hollows and ridges. Water collected in the low places or, when it sank into the ground, came out again in the form of springs which ran down into the pond or lake. Sometimes the glacier, slowly moving down a valley, carried with it a great mass of clay and gravel. When the ice sheet finally melted and disappeared, the valley was left with a dam across it, and behind it the water has collected. Sometimes the great weight of ice and stone scooped out holes in the softer stone over which it passed, and these holes have become filled with water and are fed by the little streams in the neighborhood.

The course of many streams was changed by the dams built by the great glacier. Since they could not run in the old channels they cut new ones for themselves. Sometimes they ran over hard stones which could not be cut so readily. So the water jumps instead of having a sloping bed. Many of these falls which turn the wheels of factories, mills and shops, are where they are because the course of the river was changed by the glacier. Even Niagara Falls, one of the great wonders of the world, exists because of this fact.

THE ICE SHEET FINALLY MELTS AND GREAT FLOODS COME

All the changes which came because so much of the continent was once covered by this great moving covering of ice, cannot be told here. Many large books have been written about them. We do not even know how long the ice sheet lasted. It must have been thousands of years, during which time the great ice sheet sometimes advanced, sometimes stood still, then advanced again, and sometimes drew back, as the ice melted faster than the newer ice was supplied from behind. Finally the climate again changed, the land was lowered and most of the ice melted away. However, in Alaska, British Columbia and in western United States, smaller glaciers are yet to be seen. Greenland is still covered by an ice sheet.

When the ice melted, the land was raised again until the continent became very much as it is to-day. All of this happened a long time ago as men count time. It has been at least 5,000 years, probably more than 10,000, since the ice sheet disappeared, but as the wise men who study rocks and mountains count time it is only a little while. Geologists, as such men are called, count time by centuries, instead of by days, as we do.

The change of climate, which produced the ice sheet, put an end to many of the queer animals whose bones are found sometimes buried deep in the earth. Others could no longer find the food they liked, and died. All life depends principally upon food supply. This is a fact to be kept in mind. When the white men came, many animals, some very much like those to be found in Europe, lived in the forests or on the plains. On the other hand, many animals now common do not belong to North America at all, but were brought from Europe by the first explorers and settlers. The same thing is true of many of our common plants.

SEVERAL ANIMALS AND PLANTS FOUND IN AMERICA UNKNOWN IN EUROPE

The bison, or American buffalo, was one of the most important animals belonging to America. It chiefly lived in the western part of the continent, though a few were found by the white men east of the Appalachian Mountains. Once there were millions of them and they began to grow scarce in the West hardly fifty years ago. A few are left in the United States. Recently a wild herd was found in western Canada, and the Government protected it. Now there are large herds in the Rocky Mountain Park and in Wainwright Park. The turkey is a fowl which was unknown in Europe until it was brought from America. Some of the plants were strange also. Tobacco was unknown to the Old World until America was discovered, though it is now used as much in Europe as it is in America. The tomato and the potato are also American plants,

while the Indian corn and pumpkins were unknown to the Old World.

America, however, did not have any of our common domestic animals except the dog. The wild horses, which only a few years ago were common on the western plains, were descended from the Spanish horses which escaped from their owners and ran wild. Our domestic cattle were also brought over from Europe, and the same may be said of the hog and the chicken. Though there is a wild sheep among the Rocky Mountains, the sheep from which we get our clothes and our food was brought over by the white men.

MAN FINALLY APPEARS IN NORTH AMERICA

We do not know when men first came to America or where they came from. It was before the ice sheet had entirely gone, but men who have studied the matter do not agree how long. Possibly they came over from Asia through Alaska, and then down until they spread over North and South America. It is possible that Alaska was then joined to Asia and they came over the land. Perhaps they used rude boats made of skins, or of trees hollowed out. Some men believe that Europe and America were once united by a narrow ridge of land, which could be crossed, but it is not probable that they came this way. We know that the first white men led by Leif, the son of Eric, who came over from Greenland about the year 1000, found red men in possession of the country, and the description which they left of their life and habits is very much like that of those explorers who came five hundred years afterward.

When Columbus reached land he thought he had reached Asia. Therefore, he called the natives Indians, and by that name they are generally known to-day. Some writers, however, have made a new word from parts of the two words American Indian and call them "Amerinds." This is a very good name but it has not come into common use, for when people have been using a name for hundreds of years it is difficult to get them to change.

WHAT WERE THE AMERICAN INDIANS LIKE?

Now what were the Indians like? All had reddish or cinnamon-colored skin, high cheek bones, black eyes, and straight black hair which the women wore long. The men shaved all of their heads except one lock called a scalp lock, to which they sometimes tied feathers. Few had any beard at all, though some men had a few hairs which were often pulled out by the roots. In all other ways different tribes were often much alike. Some were tall and slender, while others were short. Some were gentle and peaceable, but others were fierce and warlike; some were trustworthy, others were deceitful; some had learned a good deal about farming and building, others seemed little wiser than beasts.

Students of the Indians have tried to divide them according to height, color, manners and customs and the like. They think now that the language is the best test. If you look at a page of Dutch and a page of English you will see that many words are something alike. This is because the old English and the Dutch are related in blood. A study of the languages of different tribes of Indians shows that some of them have many similar words, and the wise men say that these tribes are related, though they may have lived a long way apart. The students of Indians say that there were fifty-five different families or "stocks" of Indians in North America, north of Mexico, and thirty more to the south. Some of these have died out, and only a few of the remainder are important.

The lowest class lived west of the Rocky Mountains. They lived almost entirely by hunting and fishing, and planted little or no land. They knew how to make baskets, but did not make pots, and lived in tents called wigwams made of skins sewed together, which they moved very often. Some of the Apaches have not changed their habits much to the present day. Some of these western Indians, however, were quite far advanced. This is particularly true of some of the Canadian tribes.

THE INDIANS WHO WERE PARTLY CIVILIZED

South of the Apaches, in what is now New Mexico and Arizona, were Indians of a higher class. They are usually called Pueblo Indians, because they lived in a sort of fort built of brick or stone and called a pueblo. These pueblos were built like great apartment houses and sometimes held several hundred families. Some of them lived close to the Apache Indians, whom they feared very much, and so they often built their houses on the side of a cliff so that they could be

reached only by ladders. They cultivated fields of corn and brought water in ditches from the hills to make it grow. They made baskets so closely woven that they would almost hold water, wove good cloth, and made jars and pots of clay which were strong enough to stand great heat. They built temples in honor of their gods, and some of the tribes used bronze tools and weapons, though stone was more common. The chief tribes are the Moquis and the Zunis, but they are few compared with their former numbers. In the picture you can see the ruins of a town built against and in a cliff. This could be reached only by ladders, which the Indians would pull up after them.

THE INDIANS OF EASTERN AMERICA AND THEIR FOOD

East of the Rocky Mountains the Indians were between the two classes in civilization, but they were not all alike, for some tribes had learned more than others. They got most of their food by hunting and fishing but they got some of it from the soil. They had learned how to kill the trees by cutting off a ring of bark around the trunks, or else they burned them down. They scratched the ground among the dead trees or the stumps with a stone hoe, or with a flat bone of a deer or a buffalo, or with a stick sharpened in the fire. Then they planted corn and pumpkins, or squashes, and sometimes beans, sunflowers and tobacco. Of course the crop was small with such poor tools, as the ground could not be broken up so that the roots could get food enough from the soil. We are told that some of the Indians had learned that they could get larger crops if they put a dead fish or two in the hole where they planted the corn, but not many tribes seem to have known this.

The corn and the sunflower seeds were pounded between two stones. Sometimes they found a hard stone which already had a hole worn part of the way through it by water, and used it to hold the corn while the women pounded with a smaller stone. They mixed the coarse meal with water and baked the cake in the ashes. When they were making a journey they parched the corn and then pounded it up. In this way they could have something to eat without lighting a fire. The smoke of a fire might have shown their enemies where they were and have been a cause of great danger.

They made pots of clay, but as they could not make them strong enough to stand the fire, they often cooked their food by heating stones and then putting them into the water. Sometimes they dug a hole in the ground and lined it with smooth stones. Then they built a fire in the hole until the stones were very hot. The ashes and coals were then cleaned out and shell-fish, green corn and game were put into the hole and covered with grass or seaweed. On the seashore perhaps you have helped in a clambake. Things cooked in this way are so good that one would almost like to turn Indian. Sometimes they cooked meat by hanging it before a fire until it was done, or by broiling it on the coals.

THE EASTERN INDIANS DID NOT HAVE OUR COMMON METALS

The eastern Indians did not understand the use of metals when the white men came, except that some tribes wore copper ornaments. Their weapons and tools were all made of stone. Some of the arrowheads are very beautiful and some of their axes were made of highly polished stone. You can see them in any museum, and in many parts of the country they are plowed up by farmers or are found when digging the foundations for houses. The arrowheads were fastened to the arrows by the tough sinews of the deer or other animals, and they also used these sinews to sew skins together. For needles they generally used small sharp bones. The Indians wore little clothing, which was generally made of deerskins. All wore shoes called moccasins made of soft skins which made very little noise as they moved through the woods. When they went to war they painted their bodies and faces to frighten the enemy.

So far as we can judge, the Indians had made little progress during the thousands of years they had lived in America. One great reason for this was the fact that our common domestic animals were not found in America. Without horses, cows, sheep, pigs and chickens it was hard to cultivate the soil or to get enough animal food. Another reason for their lack of progress was that they did not know how to use metals. Stones and flat bones are not good tools.

THE EASTERN INDIANS LIVED IN HOUSES INSTEAD OF TENTS

Many of the eastern Indians lived in houses made of bark or of branches of

trees, woven together with skins or clay. Sometimes they lived in the same houses for years, but often they left them when the summer came on and the game moved away. Often several families lived in one house, which was then arranged like a stable, and each family occupied a stall. All these families were supposed to be related, but they did not count themselves related on the father's side but on the mother's. That is, all living in the house said that they were descended from the same woman. Those who were related made up a clan, and the clan was known by the name of an animal, such as the Bear or the Wolf or the Turtle. They painted pictures of such an animal, or made an image of wood or stone and called it a Totem. The picture of this animal was often painted on the breasts of men so that it would not come off. Several houses would be necessary for a large clan.

A number of clans made a tribe, which was sometimes small and sometimes large. From the old men in every clan a ruler called a "sachem" was elected, but his son did not always succeed him. The sachems from the clans met together, made rules for the tribe and punished those who broke them. Each clan elected a war chief who led the warriors in battle. Some tribes also elected a head war chief. Generally every tribe was jealous of all other tribes and was on unfriendly terms with them, if not actually at war.

THE INDIAN IDEAS OF RELIGION AND OF SICKNESS

The religion of these Indians was curious. They worshiped their dead ancestors, the Sun, the Winds and the Lightning. Since the lightning in the sky looked something like a moving snake, they respected the snake, and many tribes would not kill one. Some of them believed in a Great Spirit, but they thought also that every man, every hill, tree, lake and animal also had a spirit. Some of these were good and some were bad. A man was sick because an evil spirit had entered his body. In every tribe were "medicine men" who were supposed to have power over bad spirits.

If the man or woman died in spite of the medicine man, the body might be placed high in a tree, where it would be safe from wild beasts. Some tribes built scaffolds and placed the bodies there, while others put their dead into huts or caves. Often they buried them in the ground and heaped a great mound of earth over them. These mounds sometimes covered many bodies. With the body they sometimes buried weapons, food and drink, which they thought would be of use in the next world.

SQUAWS NOT SLAVES OF THE MEN AS YOU HAVE BEEN TOLD

You have perhaps been told that the Indian woman, who was called a squaw, was the slave of her husband. This is not quite true. She had her work and he had his. It was his business to chase the game, sometimes many miles, and it often happened when game was scarce that he might be away for days or even weeks. He fought the bears and other wild beasts and sometimes was dangerously hurt. He made weapons and had to be ready at all times to use them. The women did the work about the hut, cultivated the ground and made the clothes. In short, the man did the work belonging to war and hunting, while the women had to do with peace. When the clan or tribe was moving the woman carried most of the baggage, but the man had to be on guard, for an enemy hidden behind a tree might at any time send an arrow toward them. The Indian seldom spoke crossly to his wife and children, and when they were safe from enemies and there was plenty of food, played games with them. The young men were very fond of games. The game of lacrosse, which you may have seen played, was an Indian game which our college boys have borrowed.

CHILD LIFE AND EDUCATION AMONG THE INDIANS

The Indian baby was called a pāpoose. He had no crib like the one you used, but, as his mother was too busy to hold him in her arms, he might be strapped to a board and hung in a tree or against a post. When the mother was traveling she hung him on her back. When he grew larger he helped his mother gather sticks for the fire, or gather berries. He had a little bow and arrows and learned to shoot. He was taught to swim, to run and to climb. He learned to track rabbits and to set traps for them and other small animals. When he grew larger he was taken on hunting trips, and at last to war.

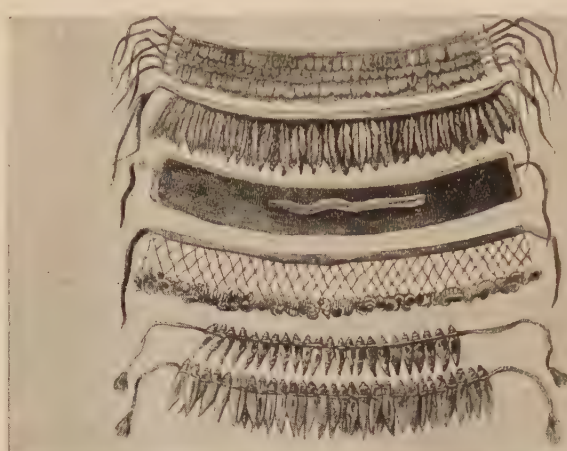
The first years of the little Indian girl were spent in much the same way. But instead of learning how to shoot she learned to prepare skins for moccasins

This stone is supposed to be the work of Aztec Indians whom Cortes found in Mexico four hundred years ago. Notice how clearly and accurately the many figures are carved upon its curved surface. They are supposed to represent the captives in war of a great king of the Aztecs in the fifteenth century, named Tizoc. It was found in the City of Mexico, and there is a copy of it in Washington.

Courtesy Southern Pacific Company.

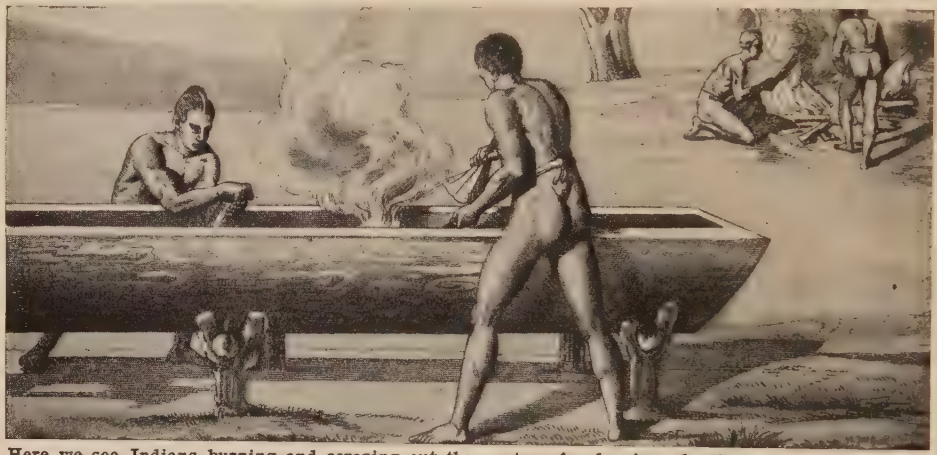
Here are the ruins of the Tonto cliff-dwellings in the Cholla Cañon in Arizona. Within great recesses, hollowed in the shelving face of a high cliff, this ancient people built rows of stone houses not unlike the buildings of our city blocks. Overhead hung a thick sheltering canopy of rock, and from the edge of the shelf the wall of the cañon dropped sheer to its deep-set stream below. Picture the cliff-dwellers on their sun-baked heights, busy with pottery-making and with cooking, or carrying burdens of food and water, the women often with sleeping babies on their backs as they went about their daily tasks.

INDIAN PICTURES THREE CENTURIES OLD



Shells strung together, used for money (wampum) and ornament.

Indian feather head-dress.



Here we see Indians burning and scraping out the centre of a log in order to make a rude canoe.

Many eastern Indians lived in huts covered with bark or clay, and surrounded by a strong fence of poles.

or for clothing, and to sew tents. She also learned how to cook and to cultivate the ground, and in some tribes the women wove coarse cloth, and made baskets and pottery.

We have spoken several times of the fact that the Indians were so often at war. This frequently happened because of the fact that one tribe hunted on the ground that was claimed by another. You think of the country as having been full of Indians. This is not true, for when the white men came there were probably not as many as 200,000 Indians in what is now Canada. In the United States there were more, but men who have studied the subject say that when the white men came there were not more than half a million Indians in what is now the United States. They have not died out so rapidly as people think.

Now, people who live chiefly by hunting must have a large territory, for game does not stay in one place like cows or sheep. Sometimes the hunter would go for days without finding anything, or if he did find it, a bow and arrow is not so good a weapon as a gun, and the deer often got away. So, in order to get close to it, he had to learn to move quietly and to learn to follow tracks. It is not true that the Indians had keener sight than the white men who lived the same kind of life. Some of the white scouts and hunters, as we shall learn hereafter, were quite as skillful as the Indians.

TORTURE OF CAPTIVES TAKEN IN WAR

When captives were taken, sometimes they were killed on the spot, but generally they were taken back to the village. Women and children were spared to help the squaws with their work. Sometimes young men and boys were adopted into the tribe to take the place of warriors who had fallen in battle. More were tortured in various ways. Sometimes the captive was fastened to a tree and the boys and young men threw tomahawks at him, trying to see how near they could come without hitting him, but his pride kept him still, for to dodge would have been considered cowardly. Finally, he was sometimes fastened to a stake, wood was piled around his feet and set on fire. As the flames grew hotter, he sang his death song telling how brave he and his tribe had always been. When the Indians captured white men they tortured them in the same way. The Indians in Canada tortured many of the Jesuit missionaries who went out to preach to them. Hunters were sometimes tortured if they were captured.

You will find the names of many Indian tribes as you read the history of Canada and the United States, but I shall give only a few of them now. The Indians east of the Rocky Mountains were divided into four great stocks called the Algonquin, or Algonkin, the Huron-Iroquois, the Athapascan and the Maskoki or Muskogian. The last lived in the South, and the principal tribes were the Chickasaws, Choctaws, Creeks and Seminoles. Their descendants now live chiefly in Oklahoma. The Iroquois lived in Canada and the United States near the Great Lakes, and the principal tribes were the Five Nations, the Eries and the Hurons. The Cherokees and the Tuscaroras, who lived in North Carolina and Tennessee, were also Iroquois. The Algonquins lived in a wide stretch of country from Nova Scotia to the Rocky Mountains.

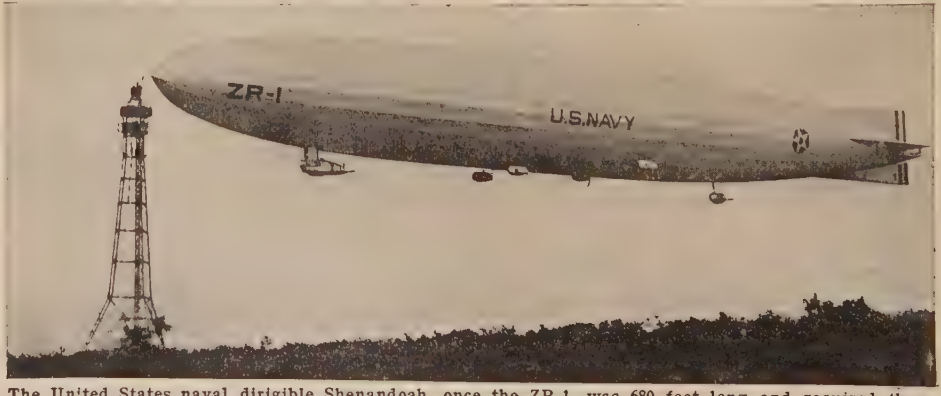
Many tribes belonged to the Algonquin stock. They were seldom so fierce as the Iroquois, though some of them fought the white men to the last, or else moved west. The Delawares, Mohicans, Pequots and Wampanoags were all Algonquins, as are the Cheyennes, Crees, Ojibways, Blackfeet and Ottawas. The Athapascans lived in northwest Canada, along the Mackenzie River.

THE FIVE NATIONS THE MOST POWERFUL OF THE EASTERN INDIANS

Of all the eastern Indians the Five Nations were the most advanced. They were so important that they are sometimes called the Iroquois, as if they alone had the right to the name. The tribes were known as the Senecas, the Cayugas, the Onondagas, the Oneidas and the Mohawks. They hated their kinsmen, the Hurons and the Eries, and often fought them. Later when the Tuscaroras in North Carolina were defeated by the whites, that tribe moved to New York and joined the Five Nations, which were afterward known as the Six Nations. These tribes had settled homes from which they did not move, and cultivated more ground than any other Indians. A few members of these tribes still live in Canada and New York State.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 241.

Here we see a steerable balloon invented by Count Ferdinand von Zeppelin, of the German army. If placed with one end on the ground it would measure nearly 500 feet, but in spite of its large proportions, it could carry only about twenty people. A steamer of the same length could carry over 1,000 passengers. This shows how clumsy a balloon is. The vast cylinder which we see here, hovering over the town of Zürich, is filled up with about twenty balloons, each full of gas, and all to hold up two little cars. Zeppelins made many voyages across the North Sea during the World War, and did much damage in England.



The United States naval dirigible Shenandoah, once the ZR-1, was 680 feet long and required three hundred men to put her into the hangar. Here she is shown moored to the mast at the Naval Air Station, Lakehurst, New Jersey, from which she was later blown off in a storm. After difficult manœuvring she was once again anchored. Photos, Illustrations Bureau, Rol & Co., and others.

Curtiss Navy Racer, holder of world's speed record: 266.59 miles per hour.

THE RIDERS ON THE WIND

CONTINUED FROM 41

FOR centuries men have been wanting to fly. Many attempts were made, with various kinds of mechanisms, only to fail. In 1782 and 1783 two Frenchmen named Montgolfier made balloons, which rose high in the air. They were inflated with hot air produced by burning straw. Two men dared to go up in one of these in 1783, and afterward many voyages were made in several countries. Soon, however, hydrogen gas was found to be better than hot air, and large balloons were built. These were the first passenger balloons, but for over a hundred years no way was found by which the flight of a balloon could be controlled. Whichever way the wind blew the balloon must go. A change in the wind might carry the balloon back toward the place from which it started.

HOW THE BALLOON WAS FINALLY IMPROVED

In spite of all the disadvantages, interest in balloons has continued to the present. Men have gone higher and higher, until now the record, made in 1901 by two German scientific men, is nearly seven miles in the air. Until 1919 the longest trip was nearly 1,500 miles. This was made in 1913 by a Frenchman who started in Paris and landed in Russia. Men have learned much about air currents and temperatures high in the air, through such trips as these. Balloons have also been of use in several wars, and are still used.

An important improvement in balloon flight was made by attaching a small engine with a propeller and a rudder to the basket of a balloon. Several attempts to construct balloons of this kind were made before 1900, but none was very successful. If there was not too much of a gale, the balloon could be guided, and might even make some progress against a slight wind.

The next steps were taken by Santos-Dumont, a Brazilian gentleman residing in Paris, and by Count Zeppelin, a German. Santos-Dumont used a sausage-shaped balloon with a pointed end, and in 1901 won a prize of $20,000 for circling the Eiffel Tower in Paris and returning to the starting-point in half an hour. The daring inventor later turned his attention to airplanes and neglected airships. Several Frenchmen and Englishmen, Major von Parseval, a Bavarian officer, and some other Germans continued to experiment, but their work was

overshadowed by the success of Count Zeppelin.

COUNT ZEPPELIN, WHO BUILT ENORMOUS AIRSHIPS

Count Zeppelin worked on another plan. He made a rigid framework for his airship, covered it with thin metal or strong cloth, and divided the interior into several compartments which were filled with gas bags. If some of these burst, the others would keep the balloon up. Cars for engines, crew and passengers were suspended from the framework. In 1900 a successful ascent was made. Other and better airships were made, until in 1910 a trip of three hundred miles was made in a little more than nine hours. This trip is famous because on it the airship carried passengers. Other airships constructed by Count Zeppelin made hundreds of trips, each carrying twenty-four passengers besides the crew. A speed of over fifty miles an hour was reached sometimes, but the airships were very large and very heavy, and several were destroyed by high winds.

GREAT PROGRESS IN THE CONSTRUCTION OF AIRSHIPS

During the World War the Zeppelins, as these immense airships came to be called, were used for military purposes. They were able to cross the North Sea and drop bombs on various parts of England, or to fly over France and attack Paris. The Allies also made many airships. They were, however, forced to remain so high in the air in order to keep out of the way of the anti-aircraft guns that they could not drop their bombs with much idea of where they were going to fall. Some of the bombs fell in open fields, and others in cities.

These airships, or dirigible (steerable) balloons, are now made in three types, called rigid, semi-rigid and non-rigid. The names almost explain themselves. The rigid has a stiff framework; the semi-rigid has a backbone to which the cars are attached; and the non-rigid is simply a balloon shaped like a sausage. It keeps its shape and lifts the cars because it is tightly inflated. At first hydrogen gas was used to fill these airships, but hydrogen is explosive and a spark may cause an accident. Recently a newly discovered gas, helium, has been used instead.

The ZR-3, built by Germany for the United States, can travel as much as eighty miles an hour, and can carry over forty-five tons of weight — passengers, ammunition or freight. A French airship, the Dixmude, since wrecked, broke a record in 1923 by traveling 4,500 miles in 118 hours without coming to the ground. Previously, in 1919, a British airship, the R-34, crossed the Atlantic from Scotland to Long Island—3,200 miles—in 108 hours. After a few days it safely made the return journey in seventy-five hours. Probably airships will soon cross the ocean on regular schedules, carrying passengers and express.

THE MACHINE WHICH IS HEAVIER THAN AIR

All of these machines are lighter than air, but the greatest success was finally to come to machines heavier than air. Many men have studied the question during the centuries. The great painter Leonardo da Vinci, of whom you read on page 823, had many ideas on the subject. Long ago others are said to have been able to glide from a height as a flying-squirrel does, but none of them really flew. During the later years of the nineteenth century many more men were working. A German, Otto Lilienthal, and Octave Chanute, an American citizen, worked on gliders with which they could descend from great heights and could guide their descent. Lilienthal made over two thousand flights before he was killed.

Sir Hiram Maxim, the distinguished English inventor, made a machine with an engine which almost flew when the trial was made, in 1894; but it was not quite right, and Sir Hiram did not continue his experiments. Professor S. P. Langley, of the Smithsonian Institution in Washington, was working on the question at the same time, and finally persuaded Congress to give him $50,000 for experiments. He had made several small machines with engines which flew without a man, and finally built a large one to carry an engineer. When it was tried, in 1903, the machinery for starting went wrong twice and the machine was broken. Professor Langley had used up all the money that had been granted him, and his failure caused so much ridicule and criticism that he is said to have died of a broken heart. He was on the right track, however, and since his death it has been shown that his machine could have flown if a few changes had been made. It is fair to say that Professor Langley is the father of the flying-machine as we have it to-day.

FRUITFUL EXPERIMENTS IN FLIGHT

The first airplanes were not steady and were liable to capsize. They would not hang motionless in the air as you may have seen great birds do. The Wright brothers spent much time in trying to find this secret of flight. They studied the proper shape and extent of wing surface and the best form of tail. Here we see Orville Wright in a glider without an engine, in which he was able to stay five minutes in the air. The picture was taken at Kill Devil Hill, a lonely spot on the coast of North Carolina. On these sands there are no trees to influence the air currents or to catch the machine. Photo Brown Bros.

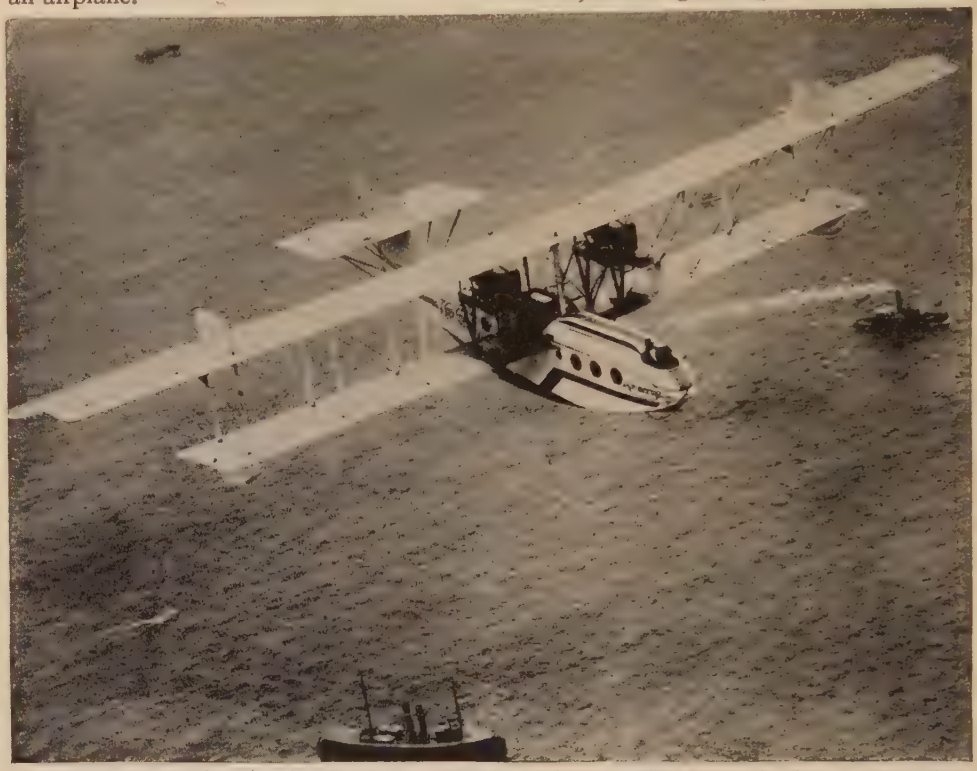
Photo Smithsonian Institution.

Professor Langley of the Smithsonian Institution at Washington was one of the most important pioneers in the struggle for the mastery of the air. His scientific training enabled him to come nearer to success than any previous inventor. This picture represents the launching of one of his earlier models at Quantico on the Potomac River, May 6, 1896. Professor Langley called the machine an aerdrome. This model was driven by a steam engine which was considered at the time a marvel of lightness for its power. This model did not carry a passenger but was projected by a complicated launching apparatus. This apparatus could not always be depended upon, and failed twice when attempts to launch models carrying a passenger were made. The machine was broken, and no more money was left for further trials.

All of these later experimenters were learning much about the size, shape and strength of the wings, but those who tried to use power found that the steam engine was too heavy for the amount of force it would develop. About this time the gasoline engine, such as we now see in motor cars, was much improved. Two young Americans decided to try to make it drive an airplane.

they kept their success secret. After this there were many improvements, but they were improvements only. A man had flown in the air.

The Wright brothers kept on trying, and in 1905 made a flight of twenty-four miles, and returned to the starting-point. Longer and longer flights were made, and in 1908 Wilbur Wright made, at Le Mans, France, the longest flights ever made up



Carrying passengers both by airships and by airplanes has become quite common in Europe, where there are several companies which maintain regular schedules and carry a large number of passengers between important cities. Fewer routes are regularly covered on this side of the Atlantic, but several are in operation. Here is an eleven-passenger flying-boat on the route between Cleveland, Ohio, and Detroit, Michigan. For the greater part of the distance the course is above Lake Erie. As you see, the engines are not in the body of the boat, but that space is left for a cabin for the passengers. In the near future there is likely to be regular service through the air between all large cities. © Aeromarine Airways.

TWO YOUNG AMERICANS SOLVE THE PROBLEM

Orville and Wilbur Wright had a shop for the repair of bicycles in Dayton, Ohio, and had had experience with motor cycles. They began in 1900 by experimenting with gliders in order to learn the best shape and size for the wings. In order that they might not be disturbed, they went to a lonely place on the seacoast of North Carolina. Finally, December 17, 1903, a machine rose carrying a man, and stayed in the air for fifty-nine seconds. The problem was solved, but

to that time. In one he covered fifty-six miles, and in another he remained in the air two hours and twenty minutes. These two Americans had been able to accomplish more than all the trained scientists and the most skillful workmen of the world.

Never was an invention hailed with more excitement. All the world realized at once that the air had really been conquered. And yet it was so simple; a huge box kite with an engine-driven propeller as a substitute for the string. Within a few months men were building flying-

SOME EARLY TYPES OF AIRPLANES

Thousands of years ago man conquered the land and the sea, but the conquest of the air is only now being realized. It is true that for more than a century men have gone up in balloons, but these have always been at the mercy of the winds; although many balloons or airships that could be steered, provided the winds were satisfactory, have been made in recent years, there is always an uncertainty about a balloon. It is the airplanes that have brought the conquest of the air within measurable distance of achievement. We here see some of the kinds of airplanes that have made successful flights. No. 1 is Mr. Hubert Latham's Antoinette airplane with which he nearly flew across the English Channel; No. 2 is the Voisin biplane; No. 3 is the monoplane in which Blériot flew from France to England; No. 4 is an early Curtiss biplane; No. 5 is Colonel Cody's airplane; and No. 6 is an early Farman biplane.

machines in all the civilized countries. Naturally those of mechanical training took the lead, and almost at once improvements were made which rendered flight safer and control by the aviator more certain. Airplanes with one pair of wings, called monoplanes, were built, and some had three. The Wright machines were called biplanes because they had two pairs of wings.

THE FIRST FLIGHTS FOR LONG DISTANCES

At first the French took the lead. Santos-Dumont abandoned balloons and built several airplanes, and in 1909 a daring Frenchman named Blériot flew across the English Channel from Calais to Dover, a distance of twenty-one miles. Then the enthusiasm of the English was awakened and Henry Farman, an Englishman, distinguished himself for his daring flights. Glenn H. Curtiss, an American, was another of the pioneer aviators who astonished multitudes by their exhibitions of daring and skill in Europe and in America. There were many others.

Mr. Curtiss also built a hydro-airplane, or hydroplane, as it is sometimes called, though other men had been working on the same idea. This is a powerful airplane which has light boats firmly attached. It is able to rise from water and to alight without danger. It is, in fact, a sort of flying boat. Other men also experimented with this idea.

Little was known of the science of flight. The designers of planes had to learn by experiment the best way to build them to stand the great strains of flight. Engines were not always reliable. The aviators had to acquire skill by themselves and learn the tricks of the treacherous air currents. It required many accidents to teach them that the higher they went the less was the danger; for in falling there was more time in which to regain control of the machine. The most serious cause of possible mishap was the sudden stoppage of the motor, which might happen through the breakage of any one of its many delicate parts. This would cause the airplane to slacken speed; then, suddenly, it would tilt backward and fall, just as you have seen a kite throw up its tail and swoop downward. Many of the early fliers lost their lives because of the faulty construction of their machines as well as their own lack of skill and knowledge.

HOW THE AVIATORS KEEP FROM FALLING

To-day the experienced aviator knows what to do in such a case. By means of the lever in his hands he throws down the elevator, as the rudder that raises or lowers his machine is called, and the front of the airplane dips, almost straight downward. To the spectators it appears that it is dropping sheer to destruction, but just before it reaches the ground, the aviator gives his lever another turn, rights his machine dexterously and alights safely. This method of landing is known as the volplane, and is now practiced even for pleasure. A safer way to volplane is to make the machine circle as it falls, which enables the aviator to choose his landing-place.

On the other hand, many dangers that were feared by the beginners have turned out to be no dangers at all. For years no aviator would venture up if more than a breeze was blowing. Then in 1909 an Englishman, Hubert Latham, forced his machine up into a fierce gale of wind. For a few minutes it fluttered dangerously against the gusts, then turned and sped down wind at the rate of ninety miles an hour. Back again came the daring aviator, making scarcely any progress against the fierce air currents. After ten minutes he alighted safely, having proved that the airplane is a good weather craft. In those days, however, forty or fifty miles an hour was considered high speed.

AN AVIATOR FLIES ABOVE THE HIGH ALPS

The following year Chavez, a Peruvian, astonished the world by flying over the Alps, and though he was killed by a bad landing on the other side, he had demonstrated that the mightiest strongholds of the air could be conquered. We do not know the height to which an airplane may ascend, but when the aviator reaches an altitude above two or three miles, the thinness of the air causes him to become dizzy and ill. The cold, too, is intense high up in the air; yet aviators have succeeded in rising over seven miles, and will doubtless go still higher into the cold air above the clouds.

Record after record was broken by the early airmen. Longer and longer trips were made, and greater and greater skill was gained. There are many good stories told of the days when flying was a novelty. Ignorant people were sometimes much

frightened at the first sight of a plane and begged for mercy.

An amusing story is told of Herr Etrich, an Austrian flier who took part in some exhibitions in England before the World War. Herr Etrich came to the aviation grounds outside London in a cab, which he forgot to discharge as he left it. After waiting some time, the cabman became impatient and proceeded to make inquiries for his late passenger among the people on the aviation grounds.

"Why, he's in France," laughed one of the aviators; "we've just had a telegram from him announcing his arrival in Calais."

In the World War, workshops to repair airplanes usually accompanied the armies. Here we see French machinists and aviators at work while above floats one of their machines which had a speed of 125 miles an hour. This car was armored underneath to protect the aviator. © Underwood & Underwood, New York.

THE INFLUENCE OF THE WORLD WAR ON FLIGHT

The performances of some of the early fliers seem almost trifling now. Some of us can remember when the news of a flight of less than a hundred and fifty miles was sent around the world. Now a trip ten times as long attracts little notice. For this rapid progress the World War is chiefly responsible. The leading nations

recognized the value of airplanes in war, and built great fleets of many different types. The most skillful designers were given unlimited money to make experiments. Schools to train fliers were established, and thousands of young men flocked to them. The qualities of a good flier are much the same as those required of an expert driver of a motor car. He must be quick-witted, his muscles must respond instantly to the orders of the mind, so that he seems to guide his plane almost unconsciously.

Presence of mind is the most necessary quality for one who wishes to fly. If only the aviator does not become frightened, an accident rarely happens. It has been calculated that on an average there is one accident to 35,000 miles of flight. A man seldom drives that distance in a motor car without an accident. So perfected is the airplane of the present time that the aviator has almost perfect control over its movements. In fact, an airplane will fly upside down as well as in upright position.

Years ago a Frenchman was flying on a windy day when his machine was overturned by a sudden gust. He continued his flight for some three hundred yards, upside down. Fortunately he was at a good height and strapped in. Finally he righted his machine and landed safely. A few months later another Frenchman, Adolphe Pegoud, overturned his machine deliberately and flew in circles, looping the loop. Now that is quite a common trick. One aviator who has performed it repeatedly says: "In looping the loop, when you start the turn, you seem to sit still and the whole world revolves around you. The horizon disappears under your feet and next you see it coming back over your head. The whole thing is done so quickly that you don't realize for a moment what has happened. There is no unpleasant sensation except a rushing of the blood to the eyes."

MEN LOSE THEIR SENSE OF BALANCE IN THE AIR

It is a peculiar fact that when up in the air men partly lose their sense of balance. The aviator knows when his machine tips backward or forward, but not when it tilts to one side or the other. To keep his level he carries a small instrument, made on the same principle as a spirit level, which is a surer guide than his own senses. The earth below also helps him to realize his position. For this reason the aviator dreads running into a fog. Then he loses all sense of direction.

It will not seem strange that the first practical use to which the airplane was to be put should be for purposes of war. What could be more valuable to a general than to be able to rise a mile into the air and observe the movements of the enemy over the country spread out below him like a map?

THE GREAT IMPORTANCE OF AIRPLANES IN WAR

This is actually what was done in the World War. Every army had attached to it what is known as the flying corps, hundreds of skilled aviators. Some of these daring scouts were the same men that gave exhibitions of skill in the early days, but special schools were maintained by the military authorities in which to train aviators.

War planes were divided into three classes: combat planes, observation planes and bombing planes. The combat planes were small and very swift, generally carrying only one person but sometimes two. The machine gun was often arranged to shoot between the blades of the propeller as it revolved. The aviator attacked other planes, or attempted to shoot down the observation balloons of the enemy. Of course he made observations as well. The observation plane usually carried an observer as well as a pilot. It was slower and steadier and carried cameras with which photographs of the enemy's position might be made. Such planes also carried machine guns for defense. The largest bombing planes can carry tons of bombs to be dropped upon forts, camps, railway stations or ammunition depots. Often several of these went out together.

In the gray of early dawn the scouting aviator rose out of camp in his machine, describing wide circles as he ascended at least a mile. Sometimes he was alone, sometimes he had with him a companion, seated in front with nothing to do but observe what was going on below. Then suddenly the machine swooped forward and darted over above the trenches into the enemy's territory. Immediately the enemy's anti-aircraft guns began popping, sending bursting shells five miles upward, while rifles cracked with a continuous roar.

Sometimes airplanes from opposing

TWO TYPES OF FIGHTING AIRPLANES

The larger of these planes is a French bombing plane used in the World War. It could carry tons of bombs, which created terrible havoc when they exploded. It carried several people. Beside it is a single-seat combat plane, which protected the larger and more unwieldy planes, or engaged enemy planes in conflict. Such a plane can dart like a hawk at an opponent and can evade capture like a swallow.

This nearer view of a part of a great British bombing plane used in the World War gives an idea of its size and power. The smaller plane can be rolled about as easily as a light motor car, but, as you see, a tractor is used to get this one into position on the field. Notice the two powerful engines and the man with the machine gun in the front of the machine. Upper photo, Boyer; lower, British Official.

sides met up in the air and then came the aviator's real danger. They began swooping and circling around each other, each striving for advantageous position. Then they began firing their rifles or machine guns until one or the other got the advantage. Pegoud, the Frenchman who first looped the loop, fought many such duels.

Nor was the use of planes confined to land. Seaplanes hovered above the fleets to act as lookouts, and to be ready to drop bombs upon the deck of an enemy ship, or else patrolled the sea looking for submarines. From a seaplane a submerged submarine, which was invisible from the deck of a ship, could be easily seen.

Flight and Flying Since the World War

Since the end of the war progress in the navigation of the air has continued. The aero-engine has been improved. Lighter, more powerful and more reliable engines have been built both for airships and for airplanes. The most thrilling accomplishment was the crossing of the Atlantic four times within the short space of two months during 1919, once by a seaplane, once by an airplane, and a round trip by a British airship.

The first successful flight was that of the NC-4 (Navy-Curtiss), a flying-boat constructed according to plans worked out by the United States Navy and Mr. Glenn H. Curtiss. The trip was made by a series of jumps: from New York to Halifax, to Newfoundland, to the Azores, to Lisbon, to the coast of Spain, and then to Plymouth, England. Three of these boats started, but two were forced to give up. Only the NC-4, commanded by Lieutenant Commander Albert C. Read, completed the journey, May 27, 1919, though once it was forced to come down in the sea. The longest jump, from Newfoundland to the Azores, about 1,200 miles, was made in 15 hours and 18 minutes.

Hardly had the wonder of this flight died away when Captain John Alcock and Lieutenant Arthur Brown, in a British plane, flew from Newfoundland to Ireland, 1,960 miles, in 16 hours and 12 minutes, completing the journey on June 15, though much disturbed by fog. A month earlier Harry G. Hawker and Lieutenant-Commander Grieve, also in a British plane, had attempted the same flight, but the plane developed engine trouble after 1,100 miles and came down into the sea. The fliers were picked up by a Danish ship, and later the plane was also rescued. We have already told you of the successful voyage of the British airship, the R-34, three weeks later. The same year Captain Ross Smith and his brother, in a British plane, flew from England to Australia in 28 days. This was another fine performance.

In 1924 two events attracted the attention of the world. One was the daylight flight of Lieutenant Russell L. Maughan from New York to San Francisco. Starting from New York just before dawn, June 23, he reached San Francisco at 9:47 the same evening, 21 hours and 48 minutes after he started, having covered a distance of 2,700 miles. You must remember that San Francisco time is three hours slower than New York time. This was not a non-stop flight, as Lieutenant Maughan alighted several times for fuel and oil.

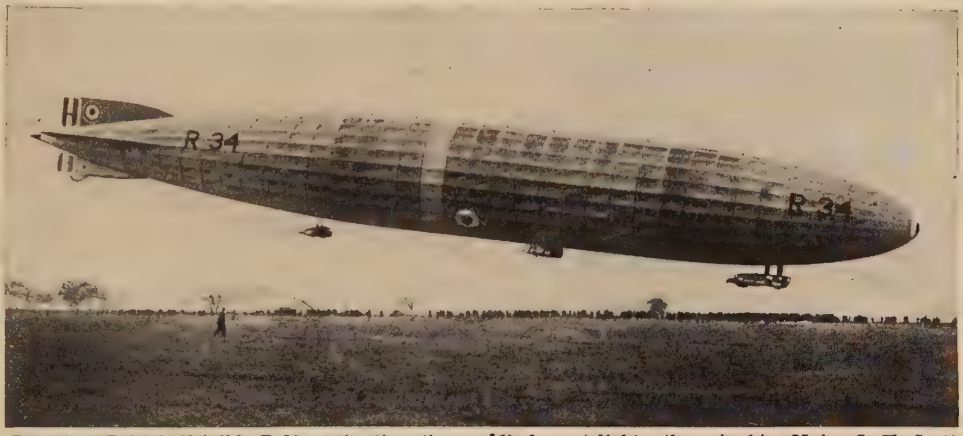
Even more thrilling was the circumnavigation of the world by United States fliers. Four planes began the journey from Los Angeles, California, March 17, but one was wrecked among the mountains of Alaska. The others kept on, making the first air voyage across the Pacific (from the Attu Islands to Japan), in 12 hours and 5 minutes. They touched Japan, China, Siam, India, Persia, Turkey, Austria, France, England, and traversed other countries. In all, twenty-one foreign lands were crossed.

By the first of August, with airplanes refitted, the fliers were ready to start across the Atlantic. From the Faroe Islands to Iceland, thence to Greenland, then on to Labrador their course lay. One of the airplanes was wrecked near the Faroe Islands, but a substitute was sent to Nova Scotia to replace it for the remainder of the flight. Touching at Newfoundland and Nova Scotia, the fliers were back in the United States by September 5, and on September 28 they completed their "girdle round about the earth" upon reaching Seattle, where they had made their official start 5 months and 22 days before. The time actually spent in flying, however, was 15 days, 6 hours.

Four new records were established in this journey. The Pacific Ocean and the China Sea were crossed for the first time by air-route; the earth was circled for the first time by heavier-than-air flying-

THREE TYPES OF MODERN AIRCRAFT

The first heavier-than-air machine to fly across the Atlantic was the naval seaplane NC-4, Lieutenant-Commander Albert C. Read, U. S. N., commanding. It started from Rockaway Beach, New York, via Newfoundland, stopped at the Azores Islands—1,200 miles—and at Lisbon, Portugal, touched the coast of Spain and landed at Plymouth, England, May 31, 1919, completing a flight of 4,000 miles.



The giant British dirigible R-34, at the time the world's largest lighter-than-air-ship, Major G. H. Scott commanding, completed the first transatlantic non-stop flight from East Fortune, Scotland, to Roosevelt Field, Mineola, Long Island—3,200 miles—on July 6, 1919, and returned to her base a few days later.

The Vickers-Vimy bomber, with Captain John Alcock, pilot, and Lieutenant Arthur W. Brown, navigator, made the first non-stop transatlantic flight of 1,980 miles from St. John's, Newfoundland, to Clifden, Ireland, in 16 hours, 12 minutes, landing June 15, 1919. She encountered fog, gales and severe thunderstorms.

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machines; and the actual traveling time for making the journey round the earth was very much reduced.

Two great rigid Zeppelins were added to the United States air fleet in 1923 and 1924. One, the ZR-1, renamed the Shenandoah, was built at Lakehurst, New Jersey, in the summer of 1923. It was a military Zeppelin, designed to carry guns and fighting men. In the space of a year this airship exhibited extraordinary serviceable qualities in several long-distance flights. One test of her strength came when in a terrific gale she was torn from her mast at Lakehurst and driven sixty miles inland through a raging storm before she could be brought under control and guided in great circles to the starting-point. In spite of the terrific strain of meeting such weather conditions for seven hours, with part of her nose rigging and covering torn away and two of her gas cells spilling out their contents, the Shenandoah rode in safety until her pilot and crew had steered her back to her own quarters. It was the use of helium that kept the airship from disaster. Combustible hydrogen spilling out from the cells and streaming about the exhausts of the engine would have exploded. In October, 1924, the great airship flew to the Pacific coast and back, again displaying remarkable fitness and endurance.

Great was the horror of the whole world, therefore, when in September, 1925, the Shenandoah was wrecked in a storm over Caldwell, Ohio. The airship broke into three sections when she was hit by a squall which forced her upward from 3,000 to 7,000 feet, where she began to break. Apparently the ship was in the vortex of the storm and was pushed and pulled in several directions at once. Fourteen officers and men, including her captain, Lieutenant-Commander Lansdowne, were killed.

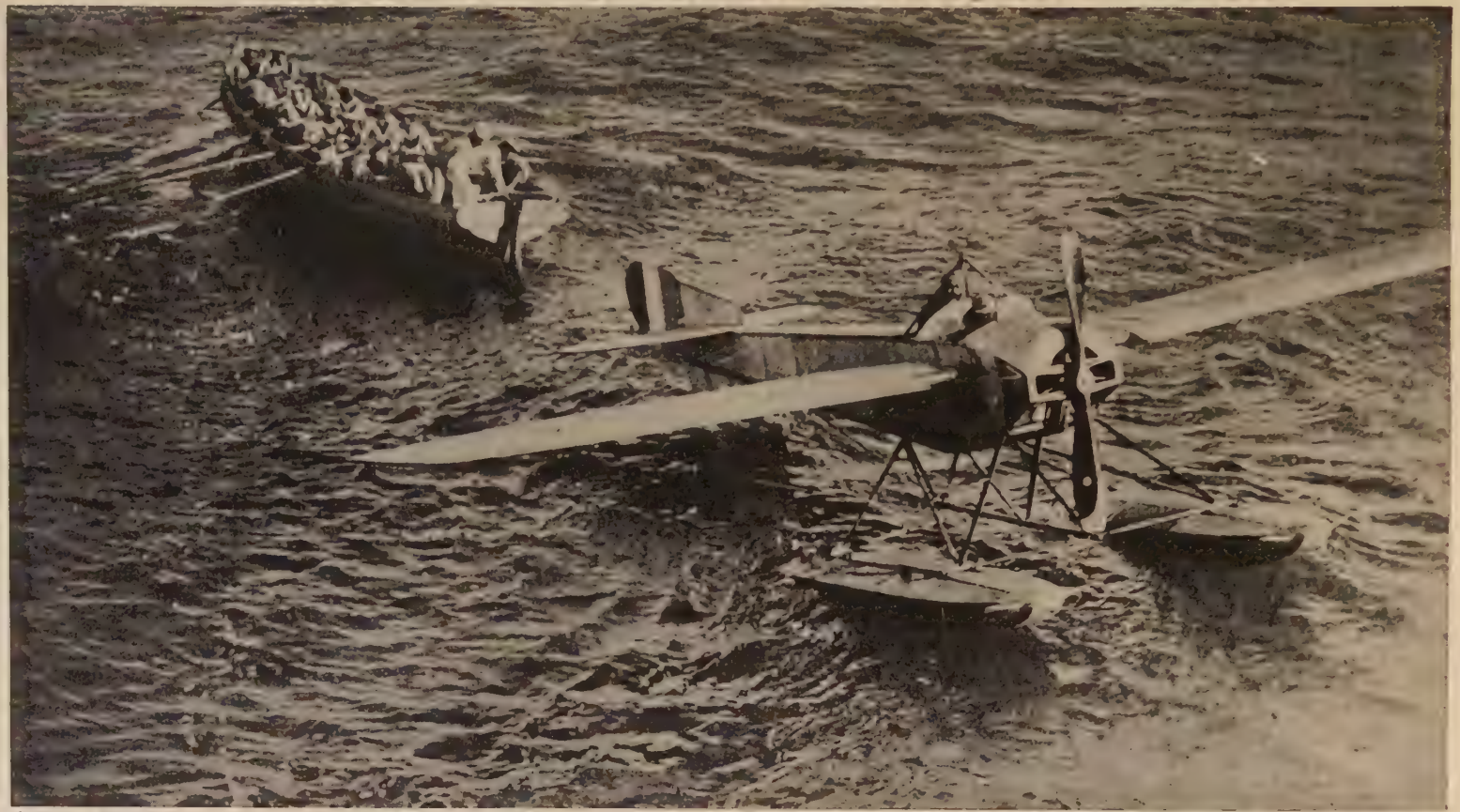
A special arrangement among the Allies of the World War sanctioned the construction of the last great Zeppelin built in Germany as a special concession to the United States Government. When, according to the terms of the Versailles Treaty, existing German airships were distributed among the powers, the United States had not accepted the two Zeppelins set apart as her share. One reason was that the Zeppelins were not very good, another that the country was not prepared to house them at that time. An agreement was finally reached that one ship twice the size of the ones destroyed should be built and delivered to the United States by Germany as a substitute for the two allotted.

This gigantic dirigible, known as the ZR-3, made the trip across the Atlantic smoothly and easily in 81 hours, arriving on October 15, 1924—the fourth air traveler to make the journey across the ocean without a stop. She was welcomed at the hangar at Lakehurst while the Shenandoah was on her transcontinental flight.

The Los Angeles, as the ZR-3 was renamed by Mrs. Coolidge, was designed especially for peace purposes, not for war uses. Except in her rigid framework, she bore little resemblance to the Shenandoah. She is 656 feet long, with a diameter of 91 feet: the Shenandoah was 680 feet long and had a diameter of 79 feet. The Los Angeles weighs 46 tons, five tons more than the Shenandoah weighed, and will carry a load of her own weight. Differing from the military Zeppelins, which begin to taper only at the ends, the Los Angeles has a hull which curves toward each end from the very centre. This structure enables it to carry heavier loads. The car of the Los Angeles, instead of being slung below the ship, is built solidly against the keel and has the control-room in front. The gas cells, so arranged that they can be frequently inspected from a corridor running from one end of the airship to the other, were charged with hydrogen gas for the transatlantic trip, but before the ship started for Washington to be rechristened the hydrogen was replaced by helium. The passenger saloon is fitted luxuriously.

In Great Britain, France, Italy and the United States interest in flying is keen, and records are constantly made and broken. Until the fall of 1924 France held the duration record for both airships and airplanes. The airship Dixmude, already mentioned, made 4,500 miles in 118 hours and 41 minutes. But in October, 1924, the flight of the ZR-3 from Germany to the United States, a distance of 5,060 miles, was accomplished in 81 hours. In July two French fliers had kept a plane in the air for 37 hours and 59 minutes, breaking records previously held by

A HYDROPLANE AFTER MAKING A SUCCESSFUL FLIGHT



Airplanes intended for use over water are called hydro-airplanes, or hydroplanes, or simply seaplanes. They are often carried on battleships, and are sent out to gain information of the effect of attacks upon fortifications, or of the presence of enemy ships. This one had alighted and was being towed back to the ship. Notice the boats which prevent it from sinking. It had made a flight over the Turkish fortifications, and a heavy fire had been directed at it, but no serious damage resulted.

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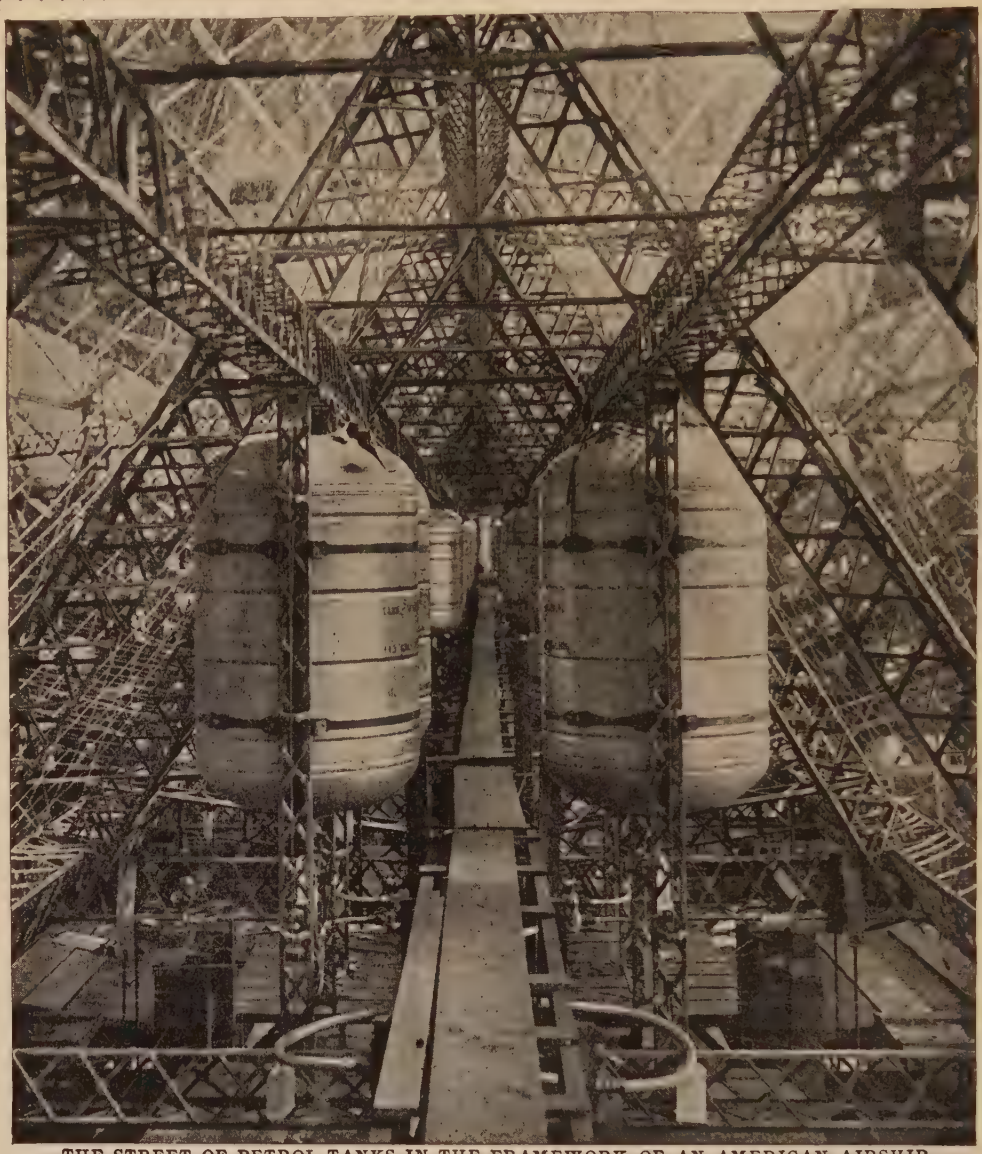


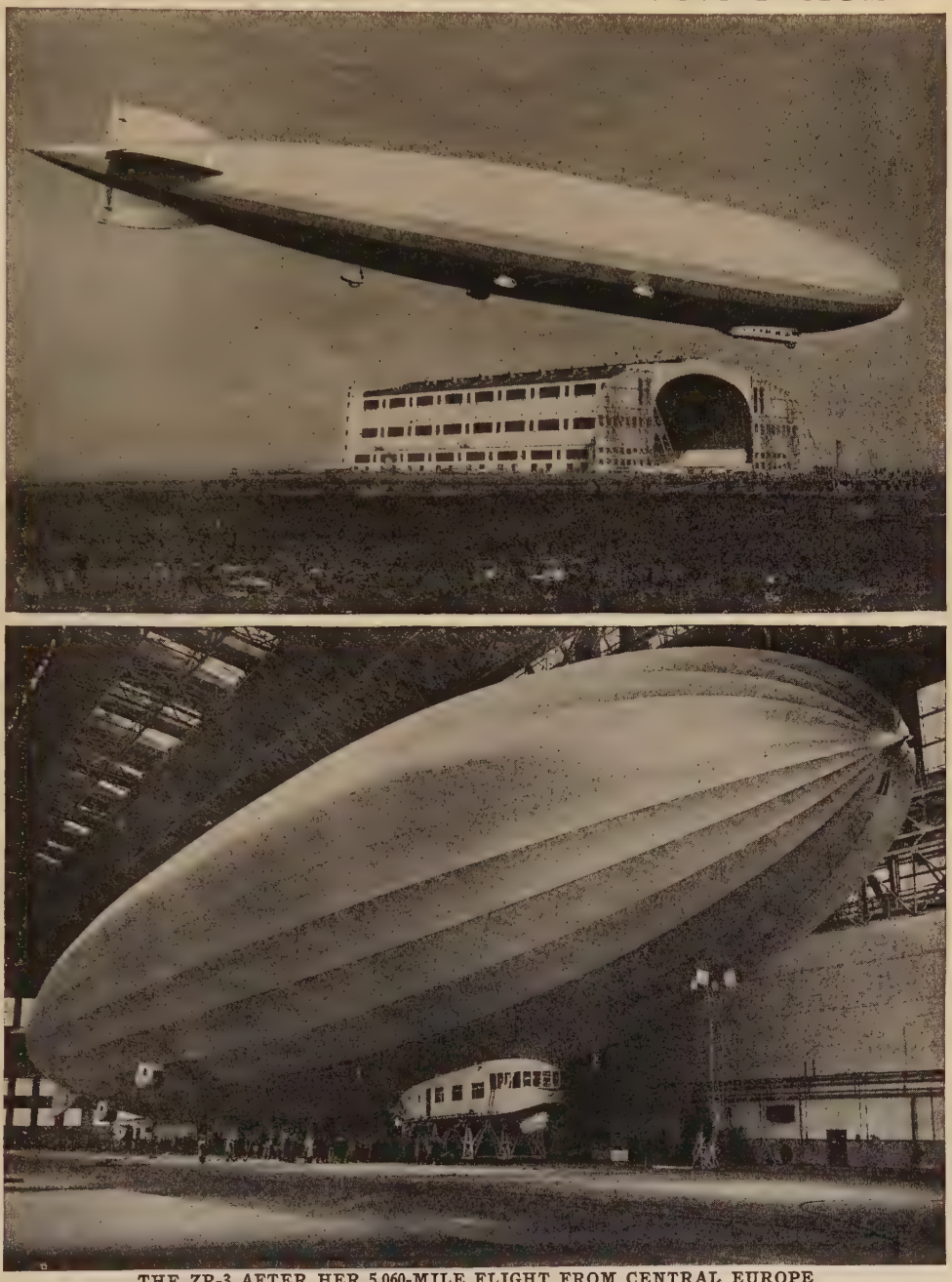
THE STREET OF PETROL TANKS IN THE FRAMEWORK OF AN AMERICAN AIRSHIP

United States officers. The altitude record was twice broken in 1923 by Sadi-Lecointe, a French flier, who reached the height of 36,564 feet, or nearly seven miles. This broke the United States record, but was, in turn, beaten by a new record set in October, 1924, by Callizo in France, who reached a height of 12,066 metres, or 39,586½ feet.

In 1923 a record for speed was made by Lieutenant A. J. Williams, U. S. N., who kept up the terrific speed of 266.6 miles an hour for twelve kilometres (about seven and a half miles). This flier also made the record of 243.8 miles an hour over a course of a hundred kilometres (62.14 miles). Then in December, 1924, Adjutant Bonnet of France made a new record of 278.38 miles an hour over a measured course of three kilometres (not quite two miles). Any of these records may be broken before this book is published. Think what they mean—over four miles a minute. The truth seems to be that the speed at which man may fly really depends upon the strength and nerves of the flier.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 197.

THE ZEPPELIN ADAPTED FOR PEACE



THE ZR-3 AFTER HER 5,060-MILE FLIGHT FROM CENTRAL EUROPE

On October 12, 1492, Columbus stepped upon the shore of America after thirty-six days on the uncharted Atlantic in a tiny boat. On October 12, 1924, the ZR-3, a giant of the air, left Germany to cross the same ocean without ever touching its waters; and 81 hours later, after a smooth journey, she set her crew and officers safely on land in the United States. Built on different lines from other dirigibles and luxuriously outfitted, the ZR-3 is planned for carrying passengers, not for fighting. Her car is larger than a Pullman sleeper and is built solidly against the keel. A wide corridor extends from end to end of the airship and can be reached directly from the control car. Thus the gas-cells can be often inspected. The hull is 656 feet long and 91 feet in diameter. It will hold 2,472,000 cubic feet of buoyant gas. These pictures show the air traveler upon her arrival in Lakehurst, New Jersey. In November the ZR-3 was renamed Los Angeles.

Photos, Kadel & Herbert News Photos.

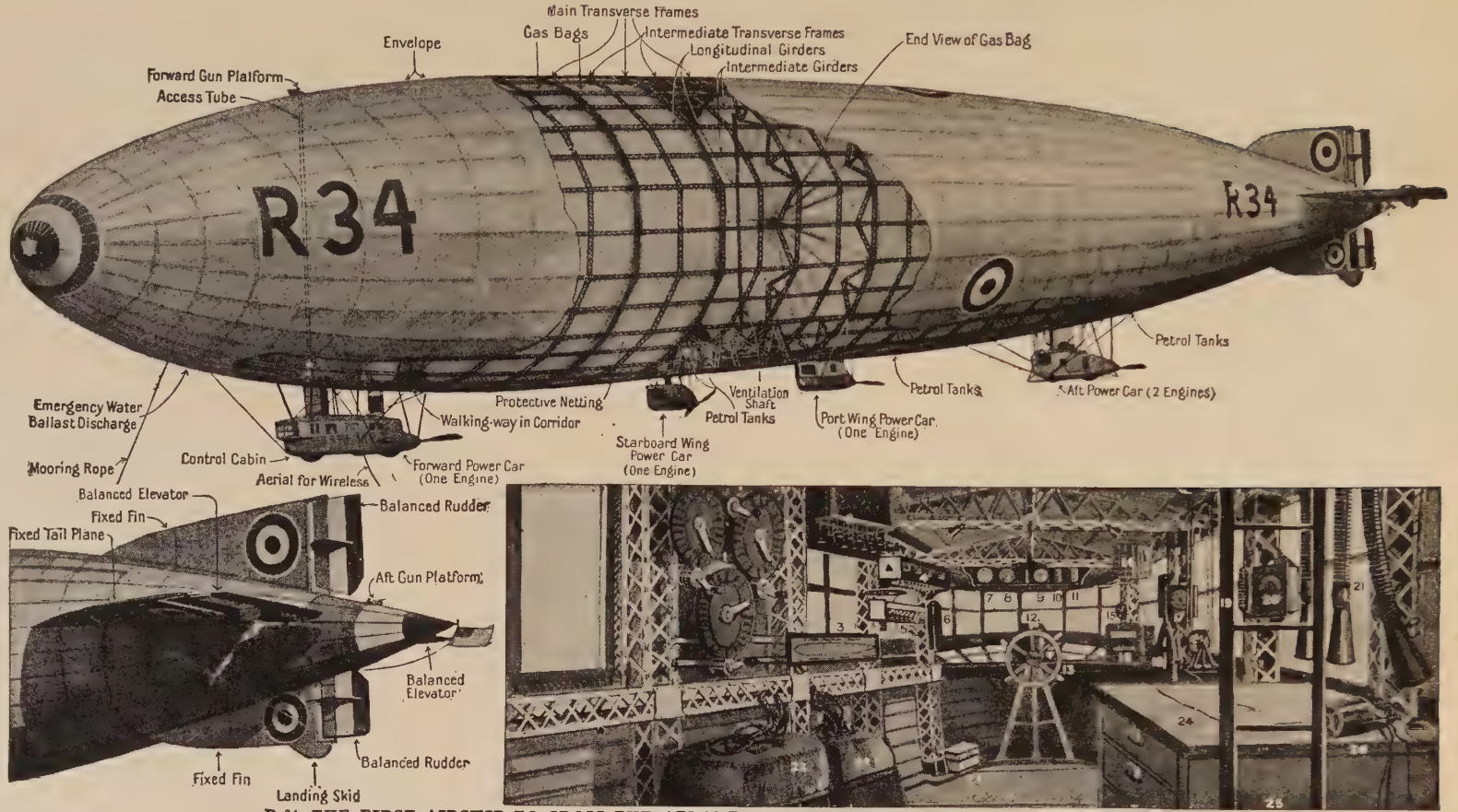
In September, 1924, three American army aviators completed a record-breaking air journey of 27,000 miles round the world. The actual flying time was 15 days, 6 hours, although the entire time between start and finish was 5 months, 22 days. The three large planes, shown here with escort planes upon their arrival, were special Douglas air cruisers with 400-horse-power Liberty motors, the only ones of their type in the world. One of the original three was wrecked near the Faroe Islands and replaced in Nova Scotia for the last stretch of flight.

Photo, Fairchild Aerial Survey.

In October, 1924, over Wilbur Wright Field, Dayton, Ohio, a new air feat was accomplished, when a Sperry messenger plane was launched into immediate flight from the army dirigible TC-5. This picture, made just as the plane was about to take off, shows it still attached to a hook hanging under the car of the dirigible.

Photo, United Newspictures.

THE MANY PARTS OF A GREAT SHIP OF THE SKIES

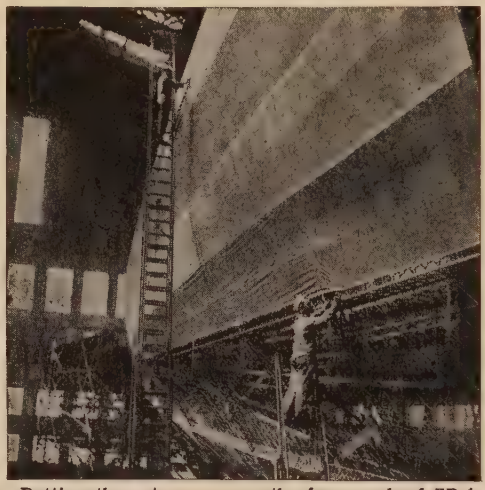


R-34, THE FIRST AIRSHIP TO CROSS THE ATLANTIC, SHOWING DETAILS OF ITS CONSTRUCTION

In the control cabin are: 1. Engine telegraphs. 2. Water ballast controls. 3. Ballast chart. 4. Gas valve control box. 5. Telephone control board. 6. Foul gas indicator. 7. Speed indicator. 8. Aneroid. 9. Clock. 10. Inclinometer. 11. Bubble statoscope. 12. Compass. 13. Rudder control. 14. Directional wireless. 15. Gas pressure gauge. 16. Wireless cabinet. 17. Height recorder. 18. Control for elevators. 19. Gas bag thermometer. 20. Rise and fall indicator. 21. Speaking tubes. 22. Parachutes. 23. Telephone battery. 24. Chart table. 25. Ladder to catwalk. 26. Signalling lamp.

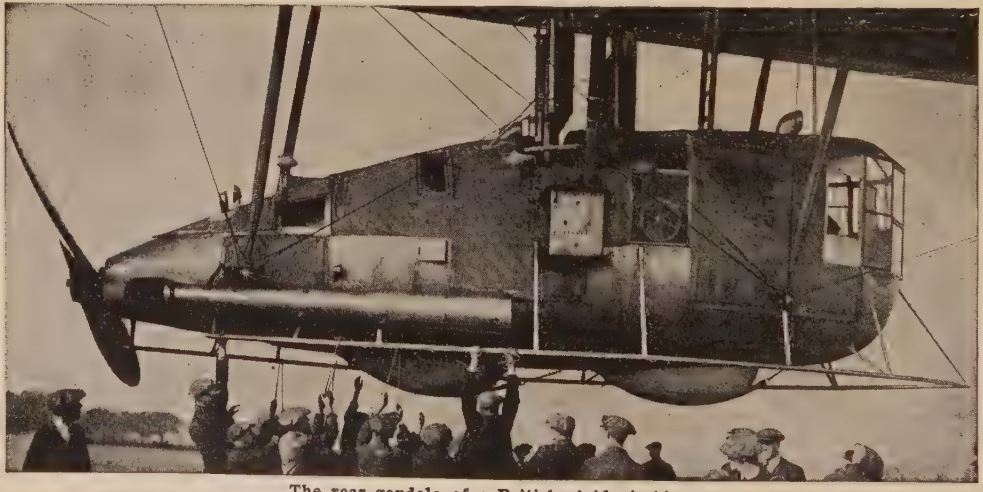
THE THREE KINDS OF AIRSHIPS

The Roma, a semi-rigid airship designed in Italy.

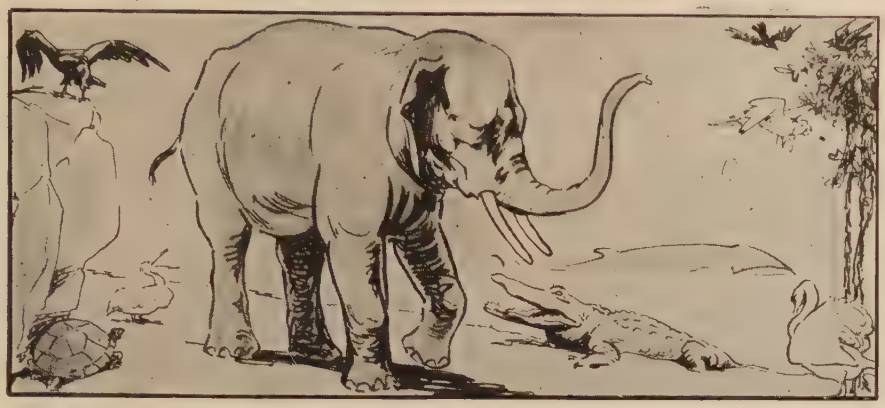


Putting the outer cover on the framework of ZR-1.

Non-rigid airship of the NS type flying over London.



The rear gondola of a British rigid airship.



HOW LONG DO ANIMALS LIVE?

CONTINUED FROM 78

WE cannot give exact figures about the age of animals as we can about the age of men and women.

We know the age to which men and women live, because the date of their birth is entered in an official register, and the date of their death also is recorded. Famous animals which are kept by men are registered in books kept for the purpose, so we know the age of prize horses, cattle and so on. But, if they remained in a wild state, they might live longer.

The prize for the land animals has to be given to the tortoise. This animal is believed to live, under favorable conditions, for between 300 and 400 years. One died at the zoo in 1906 which was stated to be at least 350 years of age. The crocodile, given fair play in its native wilds, can live for 300 years.

If we believed all the stories we read we should have to say that the toad, an amphibian, lives far longer than this, for we are often told that it can be shut up in a rock, or a tree, or in a piece of coal, and grow fat on nothing, a close prisoner for thousands of years. That, of course, is sheer nonsense.

It takes an elephant a long time to grow up, and it takes him a long time to wear out. Well treated, he should live to be a hundred. That is the age to which the eagle is supposed to live, but some people put down the age he may reach as 200 years. Even that is young compared with the life of the whale. This can be shown to last for 500 years. Indeed, some whales that have been caught are believed to have been 1,000 years old.

In the following tables the extreme ages of animals like the whale and eagle and tortoise are not given. The tables merely set out the ages to which certain animals often live.

THE NUMBER OF YEARS SOME ANIMALS LIVE

Rabbit	5	Horse	30
Sheep	12	Camel	40
Cat	13	Lion	40
Dog	15	Elephant	100
Goat	15	Crocodile	300
Cow	25	Tortoise	350
Pig	25	Whale	500

THE NUMBER OF YEARS SOME BIRDS LIVE

Wren	3	Canary	24
Thrush	10	Crane	24
Robin	12	Peacock	24
Blackbird	12	Skylark	30
Hen	14	Sparrow	40
Goldfinch	15	Goose	50
Partridge	15	Pelican	50
Pheasant	15	Parrot	60
Lark	18	Heron	60
Nightingale	18	Crow	100
Pigeon	20	Swan	100
Linnet	23	Eagle	100

It will be noticed that many animals live longer than we do, as it is very rare for man to reach the age of 100.

WHAT IS MEANT BY HERALDRY?

HERALDRY is a survival from the days of long, ago, when the social life of the people was very different from the life we live. The country was organized then, not for the general good of the majority, but for the benefit of the few—for the king with his princes and a small number of chiefs or lords acting under him and responsible to him.

It was the duty of the chiefs when the king was attacked to go to his aid, taking with them a band of retainers; and in order that among the many bands assembled in the king's army, the members of each might be able to distinguish their own leaders and comrades, each lord had an emblem, or symbol, embroidered on his garments and trappings, and on a banner borne aloft, and at a later period on the coats of his followers.

Very often the chosen symbol would have some direct reference to the lord who wore it. Thus, if an ancestor had been killed in a fight with a lion, the lord would perhaps choose a lion as his emblem; if he himself were famous in falconry he might choose a hawk; if he were of a humorous turn of mind he might select for an emblem something the name of which was a play or a pun on his own name, such as, for instance, a castle near a ford or a river for the name of Castleford.

In course of time the symbol became the distinguishing sign of the lord and his family, to be used on all occasions. It would be painted on his ceilings and sculptured on his walls, but its first use was in battle, and, as it was a part of the armament of the lord, it came to be known as his "arms." Embroidered on his surcoat it was called a coat-of-arms, and as the shield bearing the emblem was a prominent part of his outfit in war it came to be the custom, wherever the arms appeared, to draw them inside a shield.

When members of one family with a coat-of-arms married into a family with a different coat-of-arms, the two arms were combined, and, as this needed a good deal of ingenuity, there gradually grew up a science of heraldry, which arranged these things according to certain rules; and regulations were made to prevent unauthorized people from using coats-of-arms to which they were not entitled. The possession of a coat-of-arms thus became a badge of birth and breeding.

Many of the symbols used for arms were quaint and homely—birds, lobsters, beehives, acorns, grapes, wheels, sheaves, ships, leaves, musical instruments and so on. Gradually, as family after family combined their arms, these became very complicated.

Heraldry is very useful to-day in unraveling the past, for it enables those who understand it to trace the history and pedigree of ancient families and important personages, whose early story might otherwise be lost. It is in many ways the handmaid of history and has occupied the attention of the learned.

Nobody can say exactly how far back it goes, but from the very earliest period we find it was the custom for individuals and communities to be distinguished by some sign or device, and this is all the origin of heraldry. It is because war and the chase were the chief business of men in olden days that these things have provided so large a part of the symbols used and have given their vocabulary to the science.

So far as English heraldry is concerned, this grew up chiefly during the time that the Normans and their successors were in power, and as a result many of the words used in heraldry are Norman French.

The general use of armorial devices in the strict sense on shields and banners is supposed to have begun about the middle of the twelfth century. In the First Crusade the shields of the Christian knights seem to have been plain and they had no designs emblazoned on their banners, and in the Second Crusade we are not sure that there were armorial bearings.

But the idea was beginning to germinate at the time of the Norman Conquest, for on the shields of both Saxons and Normans there are simple figures something like armorial bearings, including dragons and crosses. These seem to have been the early stages of heraldry as we understand it to-day. Tournaments, of course, with all their pageantry helped to bring armorial bearings into general use, and arms soon became one of the characteristic features of the Middle Ages.

What looks to us the left-hand side of the shield is called the dexter or right-hand side, and what looks like the right is the sinister or left. The reason is that the shield is regarded from the point of view of the man who carries it.

ARE EARRINGS GOOD FOR THE EYES?

We do not know anything good that can be said of earrings; but, of course, we must not say any evil of them that is not true. It is utterly untrue that piercing the ears, with or without the wearing of earrings, has any effect at all upon the eyes. There is no reason whatever why it should have such an effect, and hundreds of thousands of cases every day prove, of course, that it has not. Perhaps, if we want to say the best we can for earrings, we may add that, at any rate, they do less harm than nose-rings, which are worn for the same reason—that is to say, for ornament—by many savages.

HAS EACH PLANET A LAW OF GRAVITATION?

The law of gravitation is not a question of any planet or star. It is a universal law. It is equally and strictly true of every particle of matter everywhere, and applies strictly between that particle of matter and every other particle, whether near or far. For us on the earth, the most important kind of gravitation is the earth's gravitation; that is simply because the earth is so near. But a book, which rests on a table under the pull of the earth, is also being pulled toward the sun, and the moon, and every star in the sky. Only the earth, being near, has the advantage, and that is why it is the downward pull we know so well, and usually call gravitation.

In the case of any of the bodies of the heavens, this downward pull depends upon its mass. Thus, if we could exist on the surface of the sun, we should find the downward pull vastly greater than here, on Mars less than here; on the moon still less, and so on. But if we think this over, we shall see that it simply means that gravitation is true everywhere, and that it is not the best way of putting it to say that each planet has its own law of gravitation.

CAN WE THINK ABOUT THINGS THAT DO NOT INTEREST US?

No. We simply cannot think of things that do not interest us; it is interest that starts us thinking. And so everyone who studies the human mind likes to see a child who is interested, wants to know, and thinks over things by himself sometimes. It is that, and not the look of him, which proves that he is a human being and not just a nice little animal.

The grown-up people who are wise, and who discover new truth, are those who do not stop thinking when they grow up; and this is because they have not lost their interest in things. It will not do to say that we cannot help being interested or not interested, for everything is interesting if we will only give it a chance. We have only to begin to think about ourselves, or the world in which we live, to find that the more we think the more interesting the things we think about become, and the more we want to go on thinking.

HOW IS IT THAT A WORM LIVES WHEN CUT IN TWO?

All animals except the very lowest depend on what we call a nervous system, which controls the power of movement, and so forth. Now, when this nervous system is all heaped together in the form of the brain, as it is in man and the higher animals, the life of a creature depends upon that brain being uninjured. But in lower creatures, like the worm, the arrangement of the nervous system is different. It is more scattered over the body, and so, when a worm is cut in half, there is enough nerve matter in either half to enable it to keep on living.

DOES A FISH FEEL?

Certainly. Everything that lives, from a microbe up to a man, has some kind of feeling. The power to feel and to respond to what is felt is a mark of all living matter everywhere, and its disappearance without return is the mark of death. But the amount and the quality and the clearness of feeling differ widely in various living things. So it would be equally wrong to say that a fish has no feeling and to say that it feels as we do. It does feel, but it does not feel as we do.

Seeing is a kind of feeling, and perhaps a fish sees quite as well as a young baby does. A fish hears, too, and smells and tastes. Also, a fish certainly has the sense of touch. It can suffer a kind of unpleasant feeling, too, and must do so, for instance, when it has a hook in its mouth; but it would be a great mistake for us to fancy that it feels sharp pain as we should if we had a barbed hook in our mouths.

A fish has only a very simple kind of brain, and cannot feel so keenly as we do. So, as to whether it is right to fish, we should decide for ourselves and then act accordingly.

WHAT HAPPENS TO OUR SKIN WHEN WE BLUSH?

The flow of blood to the skin is regulated through thousands of microscopic blood-vessels which join arteries bringing blood from the heart to veins which take it back again. Each of these blood-vessels has its own nerve to open or close it. Thus the nerve system controls the flow of blood to the surface of the skin, or to various areas of the skin's surface, just as it controls the flow of blood or oxygen to the muscles. When, therefore, the surface of the visible skin of the face becomes colored with a blush, it is because some of the nerves have turned on the tap controlling the blood supply. The nerves may be disturbed by anger, fright or shame, and turn on the tap involuntarily.

WHAT IS A CORN?

A corn is a hard growth which occurs on the toes or some other part of the feet, and is generally the result of wearing shoes which do not fit.

The corn itself is composed of the outer part of the skin, and the overgrowth of this skin in a lump, which produces the corn, is caused by the pressure of the shoe at the spot. But the corn would not result unless the pressure were taken off at intervals, and this, of course, is done when we take the shoe off. If the pressure were kept applied to this spot all the time continuously, the skin, instead of overgrowing at that point, would waste away.

It was once the custom in China to place a very tight bandage round the feet of the ladies, and this was kept on always, with the result that the feet did not grow to their proper size. So that the result of the pressure on the skin depends entirely upon whether it is continuous, and whether it is severe. The overgrowth of the skin is due to the irritation produced by the pressure.

HOW DOES OIL MAKE A ROUGH SEA CALM?

The explanation of this lies in one of the contrasts between oil and water, which we can readily observe for ourselves even when we have a small quantity of the two liquids in a couple of bottles.

If we shake the bottle of oil, we notice how slow its movements are, and how difficult it is to make it splash. It is what we call a viscous liquid. Water moves much more easily, and we call it a mobile —that is, movable—liquid. Oil calms troubled waters because it is so viscous. But it is very difficult to understand what it is that makes one liquid viscous and another mobile. Partly it has something to do with the size of the molecules of the liquid. In the case of oil of any kind, the molecules are very large.

HOW FAR OFF IS THE SKY?

What we call the sky is nothing but the appearance of blue that we get on a bright day, owing to the fact that solid particles in the air reflect the blue part of sunlight to our eyes, and also to the fact that nitrogen gas is itself blue.

When we see the blue sky, then, what we really see is air. The height of the particles that reflect this blue light to our eyes is not very great. It is perhaps fifty or sixty miles at most, and, compared with the size of the universe, that is almost nothing at all. But by the sky we may mean, not the blue sky of daytime, but the great space around us, that we may see on any bright night. We see vastly farther then than in the daytime, because we can see right through the air out to the stars; while in the daytime the sun is lighting up all the air around us, so that, though we seem to see a long way, we really cannot see past the lit-up air—except when there is something very bright beyond it, such as the sun itself, and sometimes even the moon.

HOW DO MEN FIND WHERE A FAULT IS IN THE ATLANTIC CABLE?

We must imagine that, instead of an electric cable having a copper wire in the middle, we have a long tube, into which we pour water. We must imagine, also, that the end, or bottom, of the tube is hundreds of miles away, much farther than we can see. Even then, we can tell how far off the bottom of the tube is if we know how much water we have to pour into it to fill it.

Just in this way clever men have found out how to tell the length of copper wire in an electric cable. They have instruments by which they can tell how much electricity has been put into a wire when it is full, and, as they know how much electricity one mile or one yard of wire will hold, they can tell how far off is the end of the wire—that is to say, they can calculate rather closely the distance to the place where it is broken.

THE NEXT WONDER QUESTIONS ARE ON PAGE 307.

THE CAVE-MEN AND THEIR PICTURES

CONTINUED FROM 72

THE story of art begins with a kind of fairy tale so wonderful we can scarcely believe it. Like all fairy tales, its first words are "once upon a time," and the opening paragraph takes us back at a stride to the long, long ago.

We cannot at first realize what this long, long ago means. We think of the period of ancient Greece, but our story lies in the dawn of a day much farther back. We think then of the dynasties of early Egypt, and say there can surely be nothing older; but the tale is about some people who lived and made beautiful pictures thousands of years before the Pharaohs set up their huge, fantastic statues.

When we have thought ourselves back to this long, long ago, we look for the place of our fairy story; and we find it, not in a historic temple, not in the sunlit ruins of great Asiatic cities, but hidden underground, in the half-light of the caves of Europe. We have been so used to thinking that the oldest of all artists lived in the far-off East, that it is very thrilling to realize they are our own millionth great-grandfathers, and that their art belongs to the Western World. Also, until about fifty years ago, nothing was known or guessed of these age-long treasures.

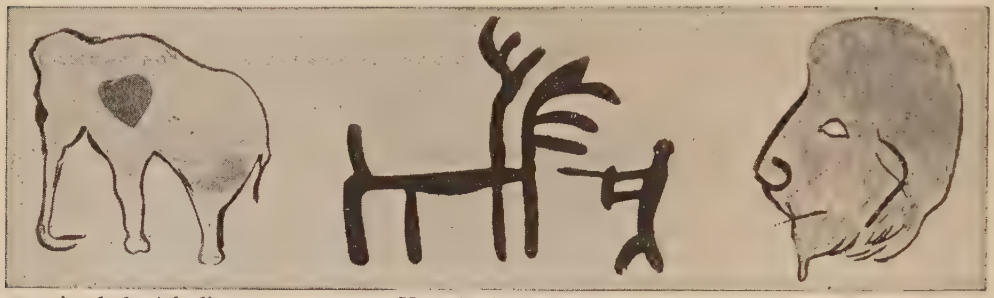
The most wonderful was found quite by accident in the year 1868 by a hunter who fell down through some brushwood into a deep hole that led to a long underground cavern. So that this incredibly old art is new for us, and is more truly concerned with hidden treasure than any story that a novelist has ever written.

In order to get to the beginning of the tale we have to go farther back than even the pictures themselves. Geologists have divided the history of the earth's development into four great periods, and, during the last of these, Europe and North America were held in the grip of an intense Arctic cold. Upon the surface of Europe were piled great glaciers, much more like the polar ice-fields than like the glaciers on the Swiss mountains to-day.

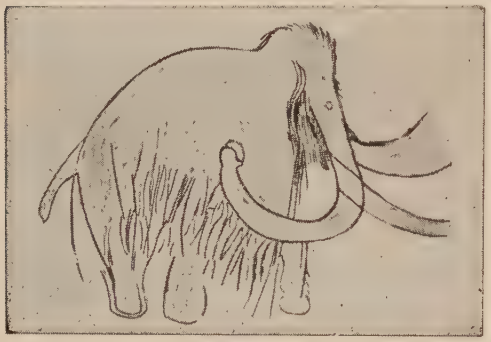
Before this bitter cold had seized the world, and in between the various epochs of the Glacier Age, the primitive tribes of Europe had been basking in a long summer. They lived an indolent, semitropical life, their food chiefly fruits and berries which were easily gathered. The Mediterranean Sea was so shallow that land bridges were possible, and men and animals trekked across into Europe from Africa and Asia. When Europe slowly cooled to the temperature of an ice-house, these earliest of all men found that life had become very hard. Their food disappeared, and they must either find

The wild boar.

An ox.



An elephant feeding. Man attacking a stag. A comical figure.



The mammoth.

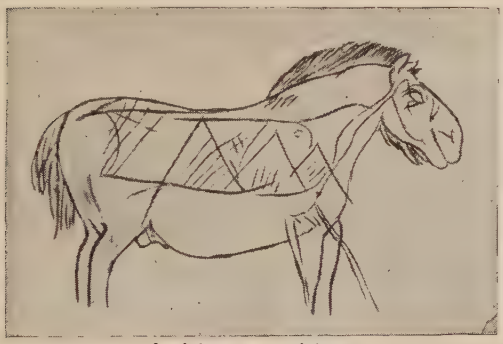
A reindeer running.

Quaint group of figures of the Stone Age.

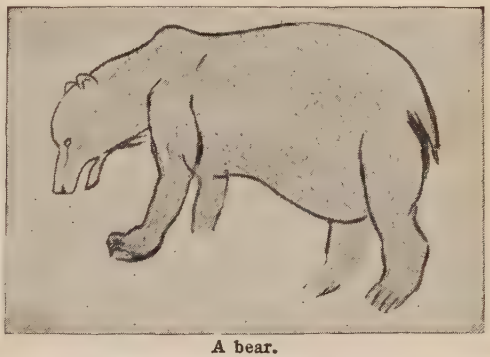
A horse.

A bison.

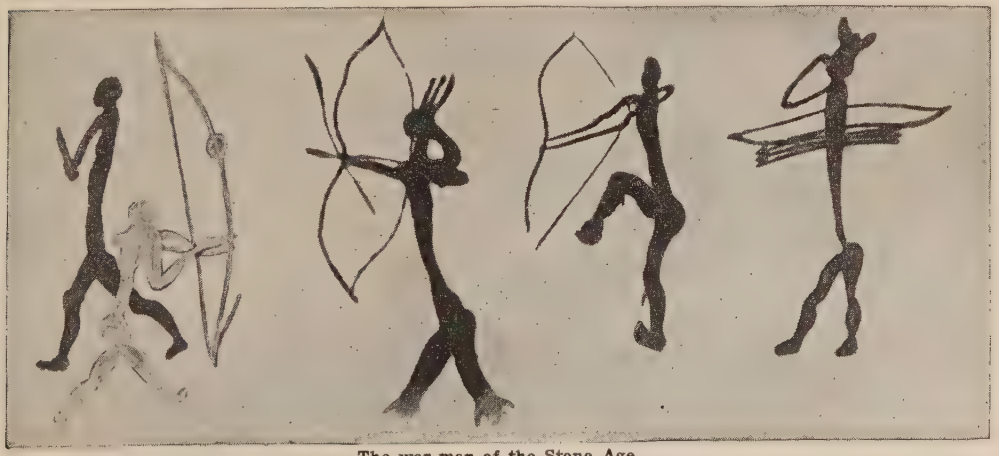
An odd procession of human and animal figures.



A picture on a picture.



A bear.



The war men of the Stone Age.

new sustenance or die. They turned for the means of life to the flesh of animals. Thus, hard necessity made of them the greatest race of hunters the world has ever known.

THE AGE OF DARKNESS WHICH WENT BEFORE THE DAWN OF HISTORY

They had only one kind of weapon—a flint knife, or dart. A perfect specimen of this implement was found with an elephant's tooth near Gray's Inn Lane, London, in England, toward the end of the seventeenth century. It was kept as a historic treasure, but was vaguely described as a British weapon. Not till over a hundred years later did scientists learn that the stone dart belonged to an incredibly remote age of the world—to the dark time which preceded the dawn of history.

If you go to the British Museum you can see this yourself—the weapon with which our millionth great-grandfathers slew mighty beasts. Because of their skill in hunting, the men who lived in Europe during the Glacier Age are often called reindeer-hunters, and because the only tools they knew were flint, their period is known as the Stone Age.

The Stone Age, however, merely marks off a stage of human culture, and has nothing to do with measurements of time. The Stone Age lasted for thousands and thousands of years. There are some parts of the world where it has not long been ended, some where it still is; for all the continents did not grow up at the same rate. Its most ancient and ancestral home, so to speak, is in Europe.

THE STRANGE LOVE OF BEAUTY THAT CAME TO THE RACE OF HUNTERS

The reindeer-hunters were driven to take shelter in caves—very often rocky holes which had been bears' dens. To keep themselves alive, they dressed in the skins of the beasts they slew. Arctic animals—reindeer, musk sheep and mammoth—roved over the frozen fields where formerly the hippopotamus, the African lion and elephant, the hyena and tiger had basked in the sun. As centuries passed by, the reindeer-hunters made a kind of rude civilization of their own. They developed their knowledge of the use of flint instruments, and had factories for their manufacture. They had cook-houses, and knew something of domestic management in their caves. Their dead were buried with peculiar and mysterious rites.

And there grew up in the minds of this race of hard, cruel hunters a strange love of beauty and decoration. It was as if their souls, struggling for expression, turned to art. We have no knowledge of their speech; they had not developed the first clumsy signs which are the beginnings of an alphabet; they knew nothing of spinning or weaving or making pottery.

Of even the simpler kinds of knowledge which underlie our present civilization they were as ignorant as the Arctic fox or the prairie buffalo to-day. And indeed, they themselves were like animals—rough, ugly, hairy beings with enormous jaws and small skulls. Their whole scheme of life centred around their hunting—the finding of food and of skins for clothing; and their thoughts were continually on the animal world around them. We may be quite sure that they had more knowledge of nature in their queerly shaped little heads than we ever shall be able to acquire; and they drew animals which show us how marvelously accurate were their observations.

THE MEN WITH FLINT KNIVES WHO WERE REALLY GREATER THAN RAPHAEL

The early drawings, it is true, are crude, and in some cases almost impossible to understand. Many can hardly be deciphered, because they have been lying for thousands of years deep down in the earth. In order to find them archæologists have to dig first through layers of the deposits of many ages, and then remove stalactites—which, we know, take an incredibly long time to form—before they can touch the original cave wall or ceiling where the pictures are.

Not all of the hundreds that have been discovered are worthy of mention, but there are among them some astonishingly excellent drawings. And the men who made them were far greater in their day than Raphael in his, because Raphael was the child of a civilization that was already old. His tools and materials were ready to use. Art had established customs. But the reindeer-hunters were the heirs of nothing but brute life and naked instincts.

Most of the work of the cave-men was a kind of rude engraving done with the point of their one weapon and tool, the flint knife. Before they reached the stage of making pictures on their walls, they tried their hand on all the small properties of their daily life—bones, tusks, teeth

DRAWINGS OF THE CAVE-MEN ON BONES AND WALLS OF CAVES

and horns of the animals they had slain. They made ornaments of shells, horn needles, tiny plaques of schist, ear pendants of various materials. For wood they apparently had a slight scorn—probably it did not seem a sufficiently hard substance.

As their civilization progressed they learned to make daggers of horn to supplement the stone dart. These were set in bone handles, whose decoration was their special delight. Dagger-handles and some mysterious horn or bone sticks beautifully carved are among the most wonderful of the remains which have been dug up out of the débris of the cave-dwellings. The sticks were certainly not a means of defense. More probably they belong to the class of sticks we call sceptres, or staffs of office. They may have marked the headship of a family. They may, on the other hand, have been wizards' wands. Archæologists have given them the name of *bâton de commandement*.

THE OLD-TIME ARTIST SITTING AT THE MOUTH OF HIS CAVE

Upon them the primitive men concentrated their daintiest and most imaginative skill. One can see in the mind's eye these dark-skinned uncouth men squatting at the mouths of their caves, tossing the hair out of their eyes as they scratched away at their dagger-handles or batons. The designs were of various kinds, sometimes repeated strokes, sometimes a leaf pattern, but more generally adaptations of animal life. For the most part, the creatures drawn can be recognized, although their forms were made too long, on account of the shape of the space. The lines are peculiarly free and lifelike.

In addition to these two special pieces of ornament, the cave-men made pictures —probably for the pure pleasure of the work—on objects which do not appear to have had any definite use. Bits of mammoth's tusks and branched reindeer horn were favorite materials, and the height of an artist's ambition seems to have been to draw all over the surface.

HOW THEY COVERED THE GALLERIES OF THEIR CAVES WITH PICTURES

Sometimes they made a procession of animals, sometimes a medley of differing forms of life. In the same way, a child given a piece of paper to draw on will cover every inch, upside down and cornerwise. And again, in this delightful child-like manner, when the artists had used all their available space, they would often begin again on the drawings they had already made. Inside the outline of a reindeer they would draw something else—a fish, or the head of another reindeer, or a horse's head; or they would find room for something that seems like a serpent.

Interesting as are these smaller objects of the cave-men's art, they give place in importance to the wall, floor and ceiling decorations of their cavern and rock shelters. There the love the artists had for animal shapes and the growing joy in self-expression found an almost endless scope. The galleries of their caves were covered with isolated drawings or long friezes; and sometimes an attempt was made to represent the massing of a herd of the creatures of the wild.

The animals which were most often portrayed were horse, reindeer, mammoth, bison and goat. Occasionally there is an outline of a kind of ox, or deer. Here and there a man is drawn, but it would seem that the cave-dwellers were not much interested in picturing themselves, perhaps because they fell short of the brute strength of the four-footed creatures.

THE FAITHFULNESS OF THE PICTURES OF THE FIRST ARTISTS

The pictures of animals which still flourish on the earth we can judge, from our own knowledge. From the skeleton of a mammoth found in perfect condition in Siberia we can judge how faithful were the drawings of this huge creature.

For the most part, these pictures were made on the rock with the point of a flint tool. Sometimes the artists scratched an outline and chiseled the interior rock away to give an illusion of "relief." Their best work was pure engraving of outline.

As their sense of art grew they supplemented the engraved line with a brush-work line. In their latest stage they had learned to paint. The substance they used, the "pigment," was a mixture of charcoal, oxid of manganese, and some oily material. Their tubes were hollow bones. Their brushes were of a fine variety, and the result is a freedom of line that most artists might envy. It is because the art of the cave-men was in a way so "artless," so free from conscious construction, that it is so great.

We find this simplicity marking the work of famous men all through the ages; for a perfect picture, like a perfect poem, should give the impression of having written or painted itself. If we are conscious that one rhyme is dragged in to match another, one shape to explain another, the poem or the picture falls short of greatness. Such a work may be clever, but, generally speaking, cleverness is the enemy of greatness. Or, to put it another way, cleverness steps in where pure inspiration fails.

One kind of cleverness the reindeer men allowed themselves in their work, and that is very interesting to us because it reveals their unconscious feeling for true shape. They took every possible advantage of the uneven surface of their rocky walls. Where a bump came that in any way suggested an animal's head or shoulder, they would avail themselves of it as if it were natural statuary, and make a line round it. In some cases this blending of relief and contour made a startlingly good, vivid piece of work; in others it would seem that the artists left the engraving unfinished.

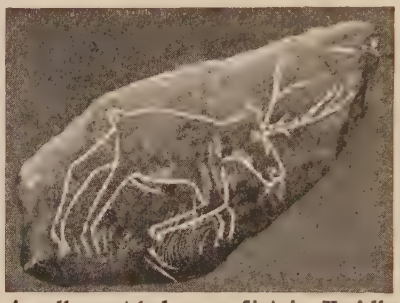
An artist before history—scratching a picture on bone.

In the southwest of France, in the district of the Pyrenees and in northern Spain, about forty of these underground picture galleries have been discovered. The conditions of life in this part of Europe seem to have been the happiest and most productive of art.

There have not yet been discovered in England any great wall engravings like those of the Continent, but the search has only just begun, so that it is quite possible that, hidden about eighty feet below the

earth's surface, there are rocky walls with beautiful friezes drawn by the cave-men.

In this fascinating branch of archæology it is impossible to say definitely to what district belong the greatest treasures. Scientists are continually exploring; and classifications made to-day may be undone to-morrow. At present, the finest and most famous wall pictures are at Niaux, near Tarascon, in France, and at Altamira in north Spain. There are few things more wonderful in the history of art than the horde of animals that chase each other across the rocky ceiling of the Altamira cave. We wonder whether they were done by one man or many, by a family or by a generation, and still more do we wonder what kind of art the cave-men would have worked out if their strange civilization had developed. All we know is that, about twelve thousand years before Christ was born, there came another of the mysterious slow earth-changes. The ice-fields melted and Europe flowed with rushing rivers and swollen lakes; the face of the Continent was altered. The bed of the Mediterranean was filled; the English Channel and the North Sea divided Britain forever from Europe. The mammoth and the reindeer retreated to the Arctic Circle, the former to disappear from the world.



An elk scratched on a flint in Norfolk many thousands of years ago.

The cave-men, dying out, gave place to a new order, who discovered metals and grain and learned to spin and make pottery. The first layer of earth and débris began to grow over the cave floors. The Bronze Age, another stage of human culture, followed after the Stone Age. The dawn of history, for Europe at any rate, then began.

The Stone Age, of course, was not confined to Europe, but it existed in different parts of the world at different times. Among certain semicivilized races the retreating Stone Age is still within hail, so to speak. Even so late as the close of the eighteenth century one third of the habitable globe had not advanced beyond the use of flint tools.

In Egypt and Palestine, and in some regions still inhabited by uncultivated peoples, there are found traces of the Stone Age, its rude, harsh way of living, and its arts. But in many countries the use of flint has been overlapped in time by the use of other tools and the knowledge of other methods and material. So the cave drawings of Europe stand out as our finest example of Stone Age art, untouched by other kinds of development. The expressions of art among the backward peoples of the earth are, generally speaking, flavored by superstition.

Only here and there do we find a faint family likeness to the pure art of prehistoric man in France and Spain. The early American Indians chiseled drawings on the face of the rocks of the Pacific coast. The Eskimos still engrave beautiful and very small designs on walrus tusks and teeth, and so on. But the Indian art degenerated into the carving of the mysterious and hideous totem poles of the various tribes. Strangely enough, the real primitive art of the Indian is a craft—basketry. The most perfect and delicate basketry in the world—woven from strands of the pith of certain trees—comes from a tribe in California. In Polynesia we find skillful engraving done on turtle shell and clever grotesque carvings in wood. The Maori races in New Zealand have left some amazing engravings on whalebone and wood, and their canoes show to what extent they have developed the art of carving.

But all these peoples lack the simplicity of thought that underlay the work of the reindeer-hunters. They revel in coarse representations of the human body and superstitious idolatry. When we think of their work and then turn back to the art of the European cave-men, we get a sudden sense of purity and vigor, as of a strong, clear wind after a thick atmosphere. The art of the reindeer-hunters is separate and distinct, and can never be forgotten.

Some fifteen thousand years have rolled over the world since those early cave pictures were made. As we think of those artists long ago it is impossible not to be moved by a sense of awe.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 289.

A flotilla of submarines running awash.

THE SHIP BENEATH THE WATERS

CONTINUED FROM 184

NO one knows the name of the man who first thought of building a boat to travel under the surface of the sea. Alexander the Great is said to have thought of such a boat. In the seventeenth century great interest had been roused on the subject, and in 1624 Cornelius Drebbel gave a demonstration with a submarine of his construction on the Thames before James I.

During the American Revolution an American, David Bushnell, invented a ship which would travel under the sea. It was made of wood, with a magazine behind containing explosives. In this little boat the daring Sergeant Lee went right under the bows of the British ship Eagle and attached the magazine to its hull. The mine was not properly fastened, however, and exploded in the water about an hour after.

Another famous American, Robert Fulton, who built the Clermont, a little later offered Napoleon a submarine for his invasion of England. During the Civil War in the United States, experiments were made with submarine boats. Later John P. Holland and Simon Lake, both Americans, M. Lanbeuf, a Frenchman, and Robert Whitehead, an Englishman, who invented the modern torpedo, made improvements, and submarines became real weapons of war. Now all navies have large numbers of them.

The latest submarines are singular-looking vessels—long, shaped something like a cigar, but flat on the top to afford standing-place for the officers and men. In the middle of the deck is a little tower called a conning-tower, and this is the only way into the boat for the crew. The observer notices also, rising from the vessel, something which looks like a tiny lighthouse, or perhaps there are several of these curious things.

Of course the submarine has engines to make it go, but these are usually driven, not by steam, but by oil engines. Its speed is much faster on the surface, where it can use these powerful engines, and the boat spends most of the time on the surface, diving only when necessary. When it is under the water it depends on storage batteries which drive electric motors, as the fumes of the oil would be harmful to the crew. The submarine is really made for attack. In defense it is helpless, unless it carries guns on the deck. The barest touch of a ship's hull will rip open its shell and send it to the bottom. As its only refuge is the sea, and as it can live only by stealth, it must have driving power that is noiseless and leaves no trace

behind it. The electric motor is practically noiseless and heatless, and leaves no bubbles. The boat has the ordinary propeller and the ordinary rudder to steer it, but it also has two other rudders which work, not vertically, but horizontally, to make the ship dive or come up.

Even with diving rudders of this sort, ordinary means cannot make a floating vessel stay under water: the weight of the vessel must be increased. Valves are therefore opened in the submarine, and through these the sea-water rushes in and fills tanks built to receive it. When sufficient water has been taken in to make the vessel sink to a certain depth, the valves are closed, and then the boat works along under water at from eight to twelve miles an hour.

Inside the ship there are from fifteen to thirty men. The ship carries compressed air, which is released a little at a time from special chambers, while the air which has become foul from having been breathed, is, like the exhaust gases from the engine, driven out of the ship. The men may have to stay for hours and hours under water. They have supplies of food, water and oil for many days.

WHAT THE DEADLY TORPEDO IS LIKE

The chief weapon of the submarines is the torpedo, though large vessels of this kind now carry guns on the deck. The torpedo itself is from fifteen to twenty-two feet long, and from fourteen to twenty-one inches in diameter. The torpedo tubes are in the bow of the ship, and each has a water-tight door at each end. To put the torpedo in position the men open only the inner door. When the missile is placed they close the inner door and open the outer one, ready for firing. The torpedo, which is pushed out by compressed air, is itself like a small submarine. It has propellers and engines to drive it, a steering rudder, and diving rudders to keep it at the right depth. But there is no one aboard to guide it, so it must be self-acting. The torpedo is also driven by compressed air, and there is a device which prevents the pressure of the air from falling off, and so keeps up the speed of the terrible missile. A torpedo can travel four times as fast as a submarine, so that a modern one has a speed for a short range (up to 2,500 yards) of forty or fifty knots, or sea miles, an hour. The head of the torpedo is filled with some very powerful explosive, and at its nose is a projecting pin which, if driven forcibly inward, will explode the contents of the head.

THE UNSEEN DANGERS OF THE DEEP WHICH THE SUBMARINE MUST FACE

The men in a submarine beneath the water cannot see what is taking place on the surface of the sea. It is possible for the officer who stands in the tower, which generally projects out of the water when the ship itself is only just under the surface, to observe what is happening on the surface of the sea; but if the submarine is traveling at a greater depth there can be no lookout in the tower.

But clever inventors have given to the crew of the submarine a wonderful eye by means of which they can see what is going on at the surface of the waters, though all the rest of the boat is under water. The marvelous instrument is called the periscope, a word that comes from the Greek word *periskopein,* "to look around."

THE WONDERFUL EYE OF THE SUBMARINE THAT CAN SEE ALL ROUND

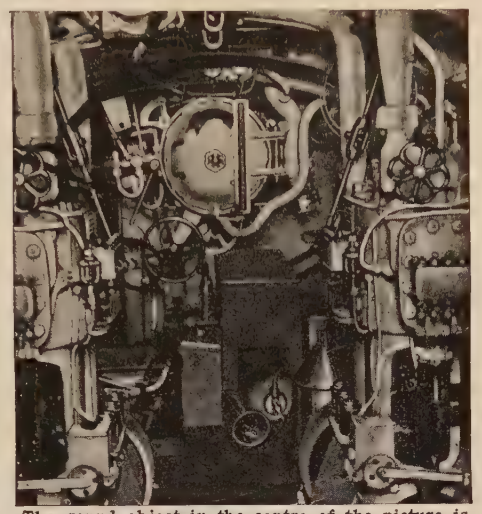
It looks like a small lighthouse, but instead of shedding forth light to enable people outside to see, it brings the pictures of outside objects inside. The periscope is a long tube that projects from the submarine above the surface of the sea. Near the top is a lens. This is the eye of the submarine. There are different kinds of periscopes. In the one in the picture on page 199 the image is reflected down the tube on to a flat surface below. The officer and crew of the submarine, by looking at the flat surface, can see what is happening all around them.

By the pressure gauge the commander can tell to what depth he has sunk. It has an open end which passes out to the sea, and the deeper down the submarine goes the greater is the pressure of water on it. As the pressure is always the same for the same depth, the gauge is marked off, and by looking at the dial the commander knows exactly to what depth he has taken the boat. A submarine cannot lie still at one depth, but must keep on the move or rise to the surface. It could anchor at any given depth but this would be inconvenient. The only time when it is stationary under water is when it lies on the bottom.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 261.

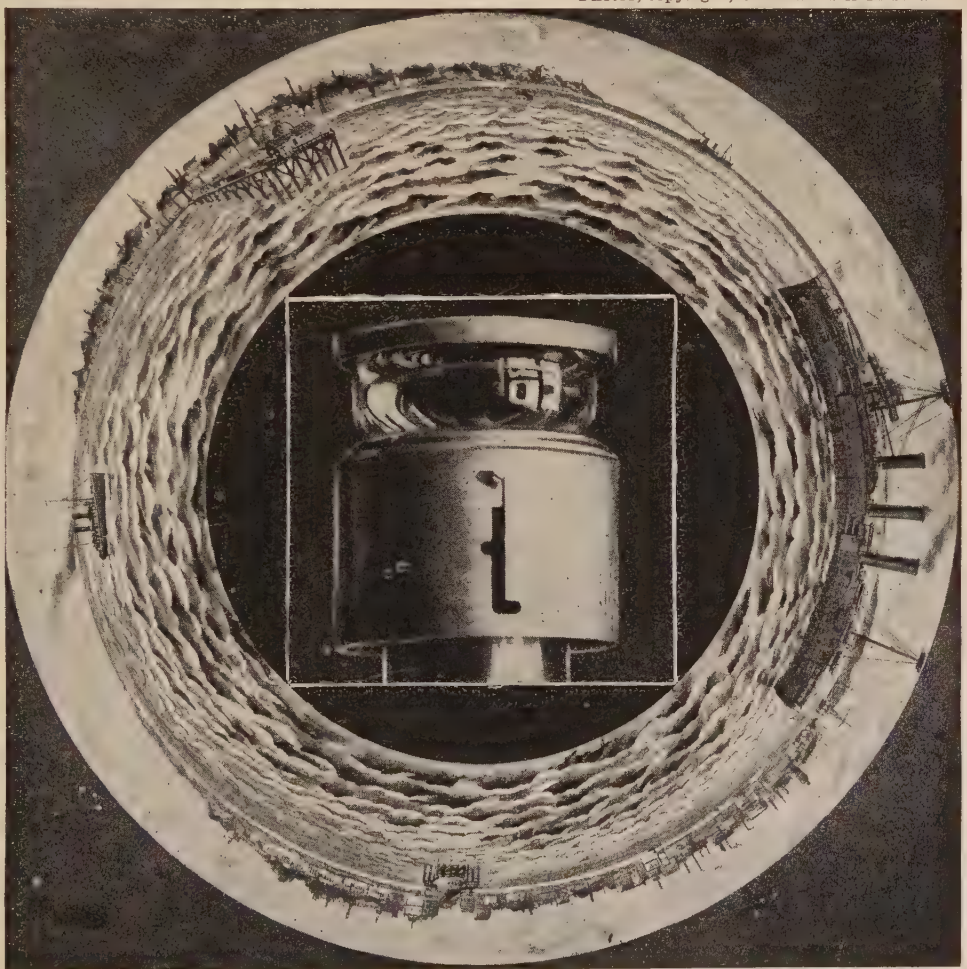
THE WONDER OF THE SUBMARINE

Here we see an officer looking through the periscope of a submarine, though the boat itself is submerged.



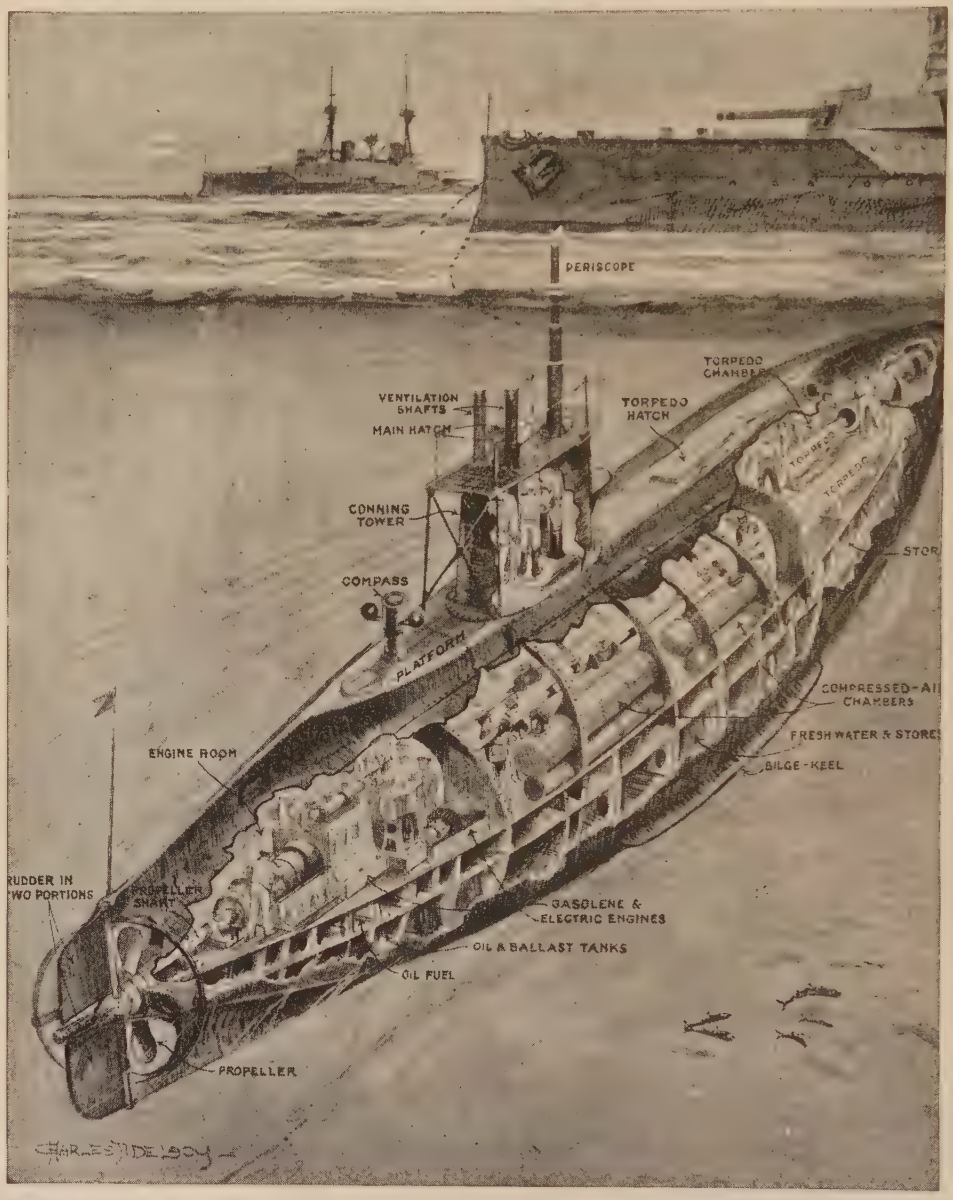
The round object in the centre of the picture is the inner door of a torpedo tube.

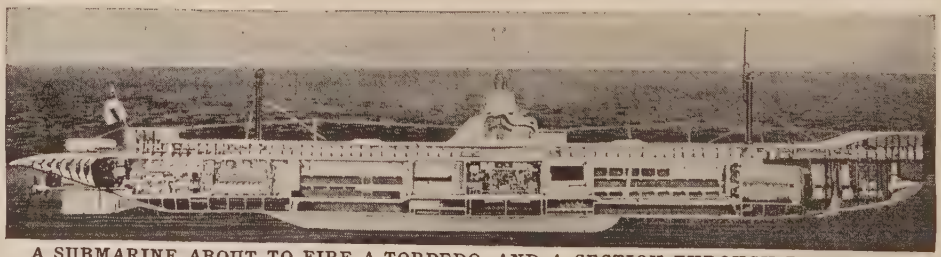
Photos, copyright, Underwood & Underwood.



The dangers of being in a submarine have been reduced by the invention of a little instrument called a periscope, with one or two of which all submarines are fitted. The periscope is the eye of the submarine.

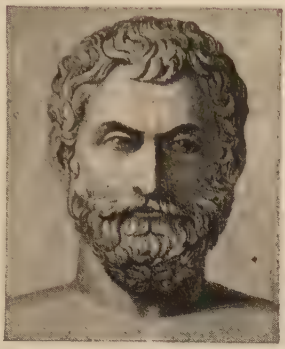
A SHIP THAT GOES DOWN IN THE SEA





A SUBMARINE ABOUT TO FIRE A TORPEDO, AND A SECTION THROUGH THE CRAFT

Copernicus.



Thales.

Ptolemy.

THE FIRST ASTRONOMERS

CONTINUED FROM 90

THE first astronomers were shepherds who watched their flocks by night, and gazed up into the skies, wondering what all the bright stars meant. In Chaldea and Egypt, in India and China, men studied the skies three thousand years before the Wise Men of the East followed the star to where Jesus was born.

No doubt the Chinese astronomers would have been glad if their sovereigns had not been so interested in astronomy, for the men who studied the skies had to prophesy the date when an eclipse of the sun would take place, so that the people might get ready with gongs and drums and make noises to frighten away the monster who, they believed, appeared in the sky to swallow the sun. If the astronomers failed in their prophecy they were killed.

Under such circumstances Chinese astronomy did not make great progress, and it was not till the time of Thales that astronomy was placed on a really scientific basis. Thales, one of the seven wise men of Greece, was born in 640 B.C. and died in 550, giving all his life to the problems of nature. He was the first to see that the sun and moon and stars were something more than signals in the sky to mark the operations of demons and gods, and he was the first to draw maps showing the relative positions of the most noticeable stars that we see in the heavens.

After about 400 years, another Greek, Hipparchus, summed up the work of all the earlier observers. He made a close study of the heavens, and was able, in a rough-and-ready way, to predict what would happen in the skies. The prophesyings of the magicians of whom the Bible tells were fraud and guesswork, but Hipparchus prophesied from scientific knowledge. He first brought astronomy to the assistance of geography, and made maps of the heavens, and of so much of the earth as was then known.

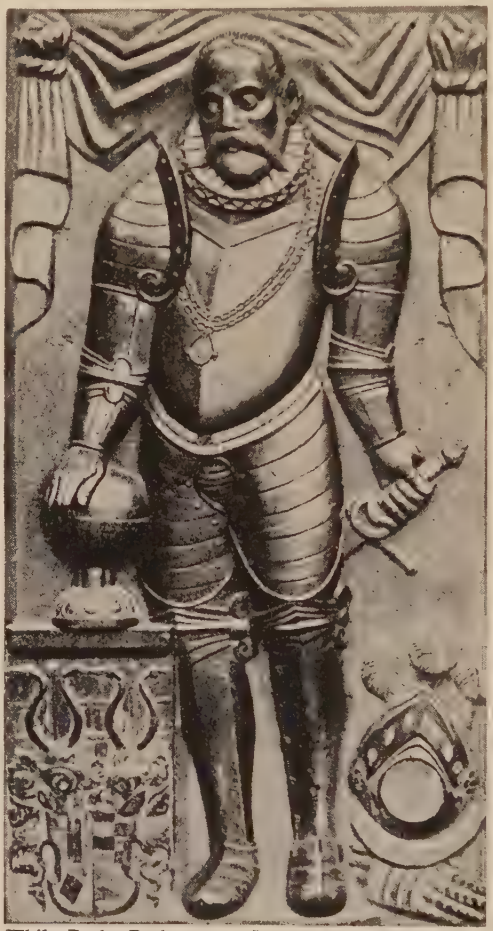
This does not seem much to us now, but it was wonderful so long ago, when very little was known of science and there were no scientific instruments for measurements. Hipparchus found out that the year as counted by the sun was shorter than the year as counted by the stars. This he learned by making measurements and comparing them with measurements taken 150 years earlier by Timocharis, another diligent student of the heavens. Hipparchus was the greatest of all the ancient astronomers, for his observations enabled him to write with skill about the sun and moon and planets, and to fix their movements with accuracy.

The next famous star-gazer we shall think of lived nearly 300 years later;

and he did, perhaps, more harm than good. This was Ptolemy, an Egyptian mathematician, and he lived in the second century after Christ. He carefully studied the works of Hipparchus, though nobody else seems to have preserved a copy. He discovered important changes in the course of the moon, and he found that light from a distant star, on entering a thicker atmosphere, is refracted, or turned aside from its path. So far so good.

The mischief that Ptolemy did was to declare that the earth exists as a fixed body in the centre of the universe, and that the heavens revolve round it every twenty-four hours. For the next thirteen hundred years all the civilized world believed this. During all that time it was thought that the sky was a solid vault, turning round on a mighty axis fitted into sockets with the stars attached to the surface of the vault.

After the Greeks, the Arabs took up astronomy. They found the works of Ptolemy, seven hundred years after his death, never questioned the theory, and worked on in the belief that all was as Ptolemy had said. Their own careful observations helped them to make more accurate tables, but they never came nearer to the real truth than Ptolemy himself had done.



While Tycho Brahe was a Dane born in Sweden, he died in Bohemia, and there he lies buried at Prague.

The modern history of astronomy dawned with Nicholas Copernicus, who was born at Thorn in Prussian Poland in 1473 and died in 1543. The son of a merchant, Copernicus had an uncle who was a bishop, who, after the death of the boy's father, had him educated as a doctor and a priest. Nicholas studied at the University of Cracow and then in Italy, where he learned astronomy as well as church law.

Copernicus, as soon as he could, settled down to be a canon at his uncle's cathedral, and devoted his days to relieving the sick and suffering, to preaching, and to the study of astronomy. He read all he could of the old writers on astronomy, and his clear mind saw that there was something wrong in the conclusions Ptolemy had reached. Night after night he would sit up in a tower and watch the stars, pondering on their mystery. He saw that the sun does not go round the earth, but that the earth and the other planets go round the sun.

But it was shocking to think such a thing in those days. All people held that God had made our earth the centre of the universe, that ours was the greatest and most important planet in the universe, and that all the heavens obediently attended, meekly whirling round and round us. If it were believed that the earth was not the centre of the universe, then, some pious men said, the importance of the earth disappeared, except for the fact that it was the home of man. They had agreed that the earth was the centre of the universe, and it was held that only the sinful would dream anything else.

Copernicus wrote a book to prove his new theory. In many ways it was faulty, but it contained great and wonderful truths, and it was the foundation of modern astronomy. He knew the danger he ran, and he feared to give his book to the world. For years he kept it by him secretly, and he was drawing near to death when he at last ventured to have it

At the age of fourteen, Tycho Brahe was amazed to find out that astronomers could exactly foretell an eclipse of the sun. Determined to study astronomy, he bought a globe and books with his own money.

JOHN KEPLER LISTENING TO TYCHO BRAHE

John Kepler, who worked with Tycho Brahe at Prague and later became his successor, believed that the teachings of Copernicus were right. When Kepler had proved the last of his three great laws about the movements of the planets, he was so pleased that he felt he must be having a happy dream.

printed. After long and anxious waiting, almost in fear and trembling for what would be thought of it, the old man received the first printed copy of his work on the very day he died.

The book at first reached the hands of only a few educated people, so the Church did not much mind, and nothing was done concerning it for seventy years. Then the Church forbade people to read it.

Not until he was dying did Copernicus have in print the book which he had written. It came from the printer just in time for him to feel the pages with his fingers.

Here, in passing, we must say a word for the first Englishman interested in astronomy. This was Robert Recorde, who was born at Tenby, in Pembrokeshire, in 1510, and died in 1558 in a London prison where they sent poor men who owed money. He taught mathematics and medicine at Oxford, but settled down in London, where he had the opportunity to make much money; but he seems to have been careless, so that he became imprisoned for debt. He is of interest to us because he was, as far as we know, the first man in England to agree with the new views put forward by Copernicus, and he was the first Englishman to write on astronomy in English. Therefore we must bear his memory in mind with gratitude.

Now we cross again to the Continent, to make the acquaintance of a famous Dane named Tycho Brahe, who was born at Knudstrup, in Sweden, when that town belonged to Denmark, in 1546, and died at Prague in 1601. Some boys have to

struggle against poverty when learning, but Brahe had to struggle against riches. His parents were distinguished people, and they hated the thought of their son's studying for the love of learning. Wishing him to be a lawyer, they sent him to university after university that he might study law as his profession.

TYCHO BRAHE, THE RICH YOUNG DANE, AND HIS CITY OF THE HEAVENS

But all the while his heart was in the heavens. With his pocket-money he bought a globe, and he sought for books that would help him in his study; but his tutor forbade him to use the globe. It was impossible, however, to suppress his interest in the stars, and through his bedroom window, with a pair of compasses as his only scientific instruments, he pursued his observations and discovered errors in the calculations of the most famous astronomers. In spite of persistent and prolonged hindrance he became famous as an astronomer, and when he was thirty his work attracted the notice of the king of Denmark, who gave him a pension and built him the finest observatory that the world had seen up to that time. This was on an island near Copenhagen and was called by a name which meant the City of the Heavens.

Here for twenty years Tycho Brahe worked at the task he loved. Copernicus had been three years dead when Brahe was born, but Brahe studied the great man's works, and improved upon them. He did not believe that the ideas of Copernicus were quite right. It seemed impossible to him that the earth could be the tiny globe which Copernicus' theory made it appear. Great as was the mind of Brahe, it was not great enough to receive that truth. He favored the belief of Ptolemy, that the sun went round the earth. The other planets, he said, undoubtedly go round the sun, but he believed that they and the sun go round the earth, which is fixed and not to be moved out of its place.

THE SORROWS OF TYCHO BRAHE AND HOW GOOD CAME OF THEM

That was the great mistake of this very earnest but rather queer and stubborn man. But his work was very valuable. He discovered new laws governing the motion of the moon; he helped forward knowledge with regard to comets; and he worked out, more accurately than anybody else had done since the days of Hipparchus, the position of some of the most important stars.

Brahe had many sorrows to bear when his friend the king died. His pension was stopped, his splendid observatory was broken up, he was compelled to leave the scene of all his labors and was exiled from his country, and he had to go to Prague. A sad thing for Tycho, it was a good thing for the world, for there Brahe met a youth who was to become even a greater astronomer than himself.

This was John Kepler, the great German astronomer, who was born in Württemberg in December, 1571, and died at Ratisbon in 1630. His parents were gentlefolk, who managed to give him a good education although they had no riches. He was educated at a cloister school, and when twenty-two was appointed to lecture on astronomy. Up to then he had had no special love for the science, but he had read Copernicus and believed in him. From this time forth he gave his life to the study of the skies.

BRAVE JOHN KEPLER AND HOW HE READ THE MYSTERY OF THE STARS

What he desired to know was how the great bright bodies in the solar system were kept in their position. He made many daring attempts to find the right answer. Some were well on the way toward the discovery; others were wild and wide of the mark. He wrote a book on what he had thought and done, and this brought him to the notice of Brahe, who appointed him as his assistant.

Brahe taught Kepler all he could, and at his death left him all his papers and instruments. Kepler was appointed to the place Brahe had held, and never rested until he had worked out the answer to the great questions he had set himself. He discovered the laws which enable us to tell the place of any planet in its orbit at any time past or present, and Kepler's laws became the foundation of a new astronomy studied on scientific lines.

Thereafter the men who gazed at the skies were to have at their command an aid that Copernicus and Tycho Brahe and Kepler had never dreamed of. With Galileo was to come a new power for men's eyes—the telescope. In the next chapter of our Men and Women, we shall find some famous astronomers who had the telescope to work with.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 279.

THE ANIMALS MOST LIKE MAN

CONTINUED FROM 97

MAN sees a likeness to himself in the animals which rank next to him in the scale of life. They form the group of creatures called Primates—the apes, the baboons, the monkeys and the lemurs. There are many of them.

Perhaps you have seen some of these great apes and have wondered at their appearance and their actions. Now, we are not descended from apes nor are apes descended from man. No one believes that, but in structure of body the highest apes resemble man very closely. They have no tails, they have hands. They have the same number of teeth that we have though theirs are larger. Their bones and their muscles resemble ours in number, shape and function.

Man with his soul and mighty brain walks upright and has become the lord of creation. The apes have kept to the trees, and when on the ground walk on all fours though they can stand upright if they choose. Their brains resemble those of man in general appearance. They can reason, to some extent at least, as some of the stories on the pages following show, but they seem to think mistily. Their movements and their actions are governed by the same areas in the brain as those of men. That is, the centres of sight, smell and the like are in the same parts of the brain as in man as many experiments have clearly shown.

The gorilla is the sovereign of the order, not by conquest, for gorillas do not come in contact with the others, but they come at the head of the order in bulk and power. They are peaceful giants, roused to wrath only if their homes are invaded. Then, although they flee if they can, they attack the boldest man, no matter how well armed he be, if their little ones are endangered. They are entirely confined to the dim forest lands of the western half of equatorial Africa, and when civilization reaches there the gorilla will vanish from the Book of Life.

For their lives cannot be lived away from trees. Enormous as they are—six feet and more in height, with a weight far exceeding a man's—they are nevertheless suited for climbing about in the leafy roofs of their forest aisles. Each foot is a hand, and all are used in climbing; the legs are short and sturdy, with the suggestion of a calf; the arms are so long that on the ground they serve as crutches. In the trees the giant beast goes with the ease and certainty of a huge squirrel.

It is so much like a nightmare vision of what a man might be that the gorilla is perhaps the most terrible of all things to look upon; yet when we come to know it, it is, in youth at any rate, as engaging as any creature living.

No pet ever excelled in intelligence and gentle merriment Johnny Gorilla,

who lived for two years in London. Six or seven others in various stages of youth had died, all within a short time after their arrival at the Zoo, but Johnny was an exception. He was caught in the forest when about a day old, and was nursed by a native woman as if he had been human.

JOHNNY GORILLA AND HIS MERRY LIFE IN LONDON TOWN

He played with a kitten as a child does; he did all the usual monkey climbing; he romped like a child. When tickled he laughed tremendously, with a deep, hoarse chuckle; when annoyed he cried "Hock, hock." He called attention to himself by knocking on the floor with his fist, and when pleased with anything he had done he would clap his hands. He drank six pints of milk and water a day, ate fruit of all sorts, was terribly afraid of worms or anything else that crawled, as if he had an instinctive recollection of snakes; and he would jump like a child if a leaf stirred, then tremblingly advance, pick it up with nervous, outstretched arm, and smell it.

The orangs rank next in size to the gorillas, but, whereas the giants are restricted to Africa, the orangs have their homes in Borneo and Sumatra. It is interesting that in the land of black men the skin of the gorilla is black, while the orang, whose home is where men are a reddish brown, is himself reddish brown. Terribly ugly, the orang has the great gaping mouth of its order, with a dismal bony ridge over the brow and an extraordinary bony development round the face.

THE TERRIBLE CREATURE THAT GRIPS WITH FOUR HANDS

"The worst of playing with an orang," said a keeper of the apes at the Zoo, "is that you never know where he will have you, for *he grips with four hands,* and his strength is that of two men." But two fine orangs made history at the London Zoo. Jacob, the larger, died from a human complaint, tuberculosis; but at the time of writing his friend Sandy is in the enjoyment of health and vigor. Caught when two years old, he lived in captivity for eight years in Singapore, and has spent seventeen in London.

Sandy and Jacob were concerned in a famous breaking-out. It began with Sandy, who twisted off a piece of the stout wire of his cage and made it into a sort of chisel. He then passed it through to Jacob, who was in the cage adjoining. Jacob improved on Sandy's plan, for, using the tool as a lever, he ripped open his wires and escaped into the ape-house. When a keeper scaled a ladder to recall him to a sense of home and duty, Jacob slid down and shook the ladder so violently as almost to throw his old friend from it.

Jacob must have dreamed of the ways of home. Through the glass beyond the wire of his cage he saw trees and grass and liberty. One night he broke through the roof of his den again, knocked out a window with a flower-pot, slipped through, descended into the grounds, chose his tree, skipped up it, made a nest of broken twigs, and lay down and slept like a king in a castle. The keepers got him home in the morning, and pretended to be cross with him. But they photographed the nest and wired it round as a great treasure —the first nest ever built by an ape in England, and the first positive proof that orangs do really make nests to lie on in the tree-tops, as the old stories said they did.

THE CHIMPANZEE AT HOME IN THE GREAT AFRICAN FORESTS

Next in size to the orang-utan is the chimpanzee, at home in the forests of equatorial Africa, but with a range extending farther east than the orang, whom, so far as knowledge goes, he never meets. Chimpanzees are heavily built, with massive arms and long, powerful hands and feet, but they are less formidable in teeth than the others, and, although grotesque and hideous, are really more like a caricature of a man than either of their relatives. A gorilla exceeds six feet, sometimes considerably more; an orang averages about five, but the chimpanzee is generally less.

Studied at short range, they seem much the same in temperament and characteristics as the orang, but, as they are hardier, they are better known, and therefore appear to eclipse the others as the authors and imitators of clever tricks. They can open doors; they learn to use cups and saucers, to eat and drink politely, to sweep out their cages, to distinguish between the sexes and show more deference to a lady than to a man. They learn to count a little, to master a bicycle and roller skates, to dress and undress.

THE GIBBONS THAT SWING THROUGH THE TREES BY LEAPS AND BOUNDS

We shall never know what these apes are really capable of, because, while they are gentle and docile in their youth, they become sullen, morose, fearfully un-

THE ANIMALS MOST LIKE MAN

ORANG-UTAN

AN OLD GORILLA

A BLACK APE

ANUBIS BABOON

YOUNG MONKEYS

CHACMA BABOON

ORANG-UTAN

CHIMPANZEE

A NISNAS MONKEY

WHITE-TAILED GUEREZA

COLOBUS ANGOLAN MONKEY

WHITE-COLLARED MANGABEY

The photographs on these pages are by Messrs. Gambier Bolton, D. Seth-Smith, W. S. Berridge, T. A. Barns, W. P. Dando, C. Reid, and F. S. Bond.

TWO BABY ORANG-UTANS SIT FOR THEIR PHOTOGRAPH

A BARBARY APE AND HER LITTLE ONE

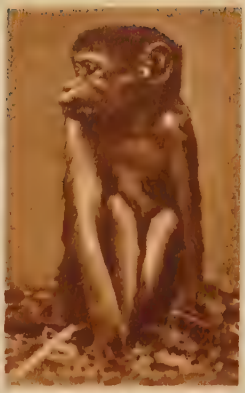
A CAPPED LANGUR WITH HER YOUNG ONE

CHIMPANZEES IN PLAYFUL MOOD

THE PIG-TAILED MONKEY

JOHNNY GORILLA

MANDRILL



MACAQUE MONKEY

WANDEROO MONKEY

GALAGO

A CHIMPANZEE TAKES A WALK

YELLOW BABOON

RHESUS MONKEY

CAPUCHIN MONKEY

SLOW LORIS

A GIBBON

RING-TAILED LEMURS

certain and often even dangerous to human beings as they grow old. Extraordinary long of arm and lissom of body, the gibbons come lowest in the scale of the manlike apes. Their brains are small and primitive, and they are the least intelligent of the groups. They can be easily tamed, for they have brain enough to receive instruction and to perform wonderful feats of gymnastics. But that is a development of their natural excellence. Although they preserve a more upright, two-footed gait than the others, balancing themselves by carrying the long arms bent over the head, they are creatures of the trees. They are not climbers so much as leapers. To them a great range of forest trees is as a succession of horizontal bars to a gymnast.

They swing through a forest by leaps and bounds. Twenty feet, thirty feet, forty feet they leap. They clutch a bough with one hand, swing off and fly through the air, catch another bough forty feet away with the other hand, and then away again, hand after hand, hurtling through the air in this way. There are nearly half a score of species of gibbons, all natives of Southeast Asia, and especially numerous in Malaya.

We must descend the scale to the lower four-handed folk—the monkeys, lemurs and marmosets. It is a great array of life, with scores of species in the Old World and the New, some of them up in the snow-laden trees of the Himalayas, most of them in the tropical forest, but one small tribe assistant guardians of the Rock of Gibraltar.

THE STORY OF THE TEN APES ON THE ROCK OF GIBRALTAR

They are called Barbary apes, but, in fact, they are simply a species of macaque monkey. They are very interesting to us for several reasons. *They are the last monkeys at liberty in Europe.* Their ancestors thronged Britain in the old, old days before the North Sea made it an island and before the collapse of a land-bridge had cut Gibraltar off from Africa. These few on the Rock are the sole survivors in Europe of days that saw England, the Continent and North Africa all one.

These Gibraltar monkeys descend from those from which the Greeks studied anatomy. They once warned the British garrison of an attempt by the Spaniards to recapture Gibraltar. They shared the common lot in the smallpox outbreak of 1894, and were reduced in number to fifty. By 1920 they had become so numerous and so bold that they invaded houses and frightened women and children in bed; they stole; they destroyed roofs; and, worst of all, their habits fouled the garrison's supply of drinking water. So the military order was: "Let no more than ten Barbary apes survive upon Gibraltar!" Poor Barbary apes! But they abound in Africa, and ten is a foundation for a new colony on the Rock.

But let us consider the monkeys in general, first distinguishing the Old World type from the New World type. The Old World species have the nostrils close together; they have food-pouches in the cheeks, and they never use the tail for anything but balancing. The American monkeys have the nostrils wide apart, have no cheek-pouches, and many of them use the tail as a grasping organ, for which purpose it serves as a fifth hand. General habits agree fairly well; a monkey is a monkey wherever you find him. Taking the average, they grow up in from five to six years, and are known to live as long as thirty years.

THE MONKEY THAT CO-OPERATES WITH MAN WHEN THE TIGER COMES

The seven genera of the Old World monkeys have the langurs at their head, a widely distributed group especially famous in India. One of the species, the hanuman, named after an Indian god, is sacred to the Hindus, and therefore at liberty to pillage right and left. Its long age of security has made the hanuman the tamest of free monkeys, and, alone of wild creatures, it seems to recognize man as a friend in the forest, and to co-operate in giving him warning of the presence of the most dreaded enemy of both, the tiger.

It may be so with other monkey tribes, but it is known that there are many Pharaohs among the grown-up male hanumans, and they hate and kill young males if they can. But the mother hanuman takes her little monkey off into the forest to nurse and hides him until he is big and strong and can go back and fight for life, and perhaps for leadership. If her baby is a female, the mother remains safely with the troop; with a male baby she flees, and braves in solitude the terrors of tigers, snakes, leopards and birds of prey for her little one's sake. That is mother-love in a dim-minded monkey!

We now come to the baboons, creatures with large doglike heads and huge teeth, ranging the lands northeast of the Red Sea. They are ferocious animals, yet capable of taming; and in the wilds they join to help one another in the face of a common foe. They combine to raise a rock which one cannot lift, in order to seek insects and reptiles for food beneath it. Retreating up a hillside from pursuit, they roll stones down at their foes, and, at need, a detachment will advance in good order to rescue an unfortunate comrade. They are hideous and savage, but have splendid qualities. The old Egyptians worshiped them as if they were gods.

QUEER LITTLE MEMBERS OF THE TEN BIG GROUPS OF AMERICAN MONKEYS

The American monkeys, all creatures of the hottest parts of the continent, abound in the forests of the Amazon and the Orinoco. They are all tree animals, and it is they who have made extra hands of their tails. Wonderful creatures many of them are, clinging, climbing by their tails, even employing them as fingers to pick leaves and other food. There are ten big groups of them. Some have faces like tiny aged men; among the squirrel monkeys we find little gems of pathos and comedy, which smile when they are pleased, shed tears when they are sad, and are all the while as mischievous as the tiny jolly baby children whom they resemble.

These are the midgets of the family; at the other extreme are the howlers—giants by comparison—thirty inches long, with voices which can be heard for miles when a howler is really trying to howl. They have howled so long, so much and so loudly that their throats have changed to enable them to do their vocal best.

THE BEGINNING OF THE HONORABLE AND ANCIENT ORDER OF PRIMATES

Those delightful pets, the marmosets, the special product of South and Central America, are much more like squirrels and ideal mice than monkeys; but they are nevertheless four-handed mammals. They have thirty-two teeth, as we have, whereas an American monkey has thirty-six. They are ancient and primitive; they remain as a sort of living bridge to show how the monkeys crossed from a lower level of animal existence to the position they now occupy in the scale of creation.

Now we come deeper and deeper still to the bedrock of the order, the lemurs. The honorable and ancient order of Primates took its rise in the humble lemurs and their kin. More like little foxes, opossums, mongooses, squirrels, seem the lemurs to-day. Yet science fixes on these animals as representatives of that source which gave rise to every monkey and every manlike ape in existence. Their headquarters is Madagascar. They reached Madagascar when it was part of the African mainland. A land-bridge sank, and Madagascar was an island, and to the lemurs it became what Australia has been to the kangaroo and their cousins. There, sheltered from the turmoil and striving which urged other animals along, they let time and transformation go by.

Infinite variety marks the forms and colors of the lemurs—some like weasels; some like mice, going to sleep during the hot months like a desert plant and waking with the rain; lemurs which are so meek and mild as to be called "gentle lemurs"; and so on, until we come to an extraordinary one called the aye-aye. This has teeth like a rat or a rabbit and a unique skeleton-like middle finger with a hook-like claw, a wonderful modification enabling the animal to scratch out insects from their hiding-places in the bark of the trees which it explores by night.

THE GALAGO, THE LORIS AND THE LITTLE TARSIER

On the African mainland is a well-known lemur called the galago, which has kept itself in the densest twilight forests. Seeking farther, we find the lorises, whose habits suggest the beginning of sloth life. They live entirely in trees. At the end of the long procession come the tarsiers, with extraordinary little kangaroo-like hind legs, absurdly long feet and hands, and quite unique claws. The tarsier leaps like a kangaroo, springing from bough to bough. A native of the Malay Archipelago and the Philippine Islands, it is rarely found.

This quaint little animal, smaller than a squirrel, seems to be one of the oldest forms. It has thirty-four teeth, and enormous eyes, large ears and a long thin tail. It moves about only at night. So great are the differences between the different monkeys that it is hard to believe that they all belong to the order in which the scientists have placed them.

These men of science, however, study the skeletons, the teeth, the muscles and the organs of the body, and have no doubts.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 315.

POETRY MORE PRECIOUS THAN GOLD

CONTINUED FROM 81

IT is a splendid thing to say something the world will never forget. That has been done often by great men and women who have written fine thoughts in words so beautiful that the books in which they are found will never die.

Many of these thoughts that cannot be forgotten are in poems, for poetry is far easier to remember than the ordinary reading called prose. There are thousands of poems that everybody ought to read because they preserve the world's choicest thought in the choicest words. Those who do not read these poems can never know how fine a thing reading is.

True poetry is more precious than gold. It makes us good and happy and hopeful, and the words sound like music.

When we write a story, or tell about a place, or a thing, or an event, in words like those we use in speaking to each other, but choose them carefully to express our meaning, as well as to have a fine and pleasing sound, we use prose. But when grander events and more beautiful scenes are described, or nobler thoughts stir our spirits deeply, demanding words more thrilling or sweeter and more musical in sound, we use poetry. Poetry is expression made perfect, the best thought in the best words.

At first poetry was great joy or great sorrow put into song. Long ages ago, when our far-off forefathers could not even read or write, they had poets who went with them into battle to compose verses to celebrate victory, or make lament for defeat. These verses were sung while they played a harp, so poetry then was feeling expressed in words suitable for singing.

We think of poetry now as it is read in books, but at first before books came it was only known by being heard, either sung or recited; and making it in simple forms was quite common. The earliest English poet we hear of, Cædmon, tells us how ashamed he was when, as he sat with a circle of companions and the harp was passed to him, he could not make and sing his verse in turn. It was in this way that the short stories in verse, which we call ballads, were first composed, not by one poet but by many, and then passed on by word of mouth.

Poetry is grouped into three kinds—Epic, Dramatic and Lyric. Epic poetry is an extended description in grand and noble words of some great event, or of the career of a hero, or of a period in the history of a nation. Dramatic poetry is written in the form of people speaking to each other, and is acted on the stage. Lyric poetry was originally intended to be sung to the playing of the lyre, an ancient form of the harp. All beautiful songs come into lyric poetry.

Sometimes poetry is written in rhymed lines, the words at the ends of the lines having similar sounds, as in

The world is so full of a number of things,
I'm sure we should all be as happy as kings.

The lines in which the rhyming words occur need not be next to each other. They may alternate, as in

Arabia's desert ranger
To Him shall bow the knee,
The Ethiopian stranger
His glory come to see.

Or the rhymes may be otherwise separated, as in the lines

Ring out, wild bells, to the wild sky,
The flying cloud, the frosty light;
The year is dying in the night;
Ring out, wild bells, and let him die.

Some lines, too, may have rhymes and others be unrhymed, as in

Blue were her eyes as the fairy flax,
And her cheeks like the dawn of day,
And her bosom white as the hawthorn buds
That ope in the month of May.

Here *day* and *May* rhyme, but *flax* and *buds* do not. The advantage of rhyme is that it pleases the ear, and helps us to remember the words, the sound speeding us on to the next similar sound. But rhyming does not make poetry. It is the beauty of the thought and the balance and melody of the words that make true poetry.

THE POETRY THAT TELLS OF GREAT EVENTS AND HIGH IMAGININGS

And, indeed, much of the finest poetry has no rhymes, but is balanced in lines with such dignity and sweetness that it is grander than rhymed verse. This form of poetry, called blank verse, is used to tell us of great events, tragedies, high imaginings and noble deeds. Shakespeare and Milton wrote most of their works in this way. Here is an example from Shakespeare, describing Brutus:

His life was gentle; and the elements
So mixed in him that Nature might stand up
And say to all the world, This was a man!

How fine these lines sound! They have the solemn music of a grand organ, and need no rhyme; but each line balances with the other in syllables and accent.

Lyrical poetry is divided into verses. Strictly speaking, a single line of poetry is a verse; but usually any two lines, if they come together and rhyme together, are called a couplet, and three or more lines may combine into a verse. Another name for a verse is a stanza. Four rhymed lines are called a quatrain.

THE LONG, LONG HISTORY OF THE SWEET ENGLISH TONGUE

The sonnet is a form of poetry that has been used with beautiful effect by nearly all the greater poets. It develops and illustrates one main thought in fourteen lines. An elegy is a mournful poem about the dead. An ode is a song of praise, and was originally written to be sung or set to music. Psalms and hymns are the poetry of worship.

English poetry has a very long history. It began when the English language was so different from the language we speak now that few of us could understand it. But for five hundred years our language has had nearly its present form, and though in modern times it has been written in more varied forms than before, its poetry has not been written more sweetly or nobly than it was written three hundred years ago. A collection of the best poetry is given in other parts of our book where we have the work of all those poets whose songs come echoing to us down the corridors of Time.

POETRY THE MUSIC OF THOUGHT AND FANCY AND NOBLE FEELING

It is our great hope that we may lead our readers into a love of poetry, which should be as natural for us to love as it is to love music; for poetry is the music of thought and fancy and noble feeling. The liking for it should be as quick as the liking for sweet sounds and scents, the color of sunsets, or the thrill of splendid deeds.

Better than all other means, it expresses these delights. It can record them for us and bring them back to us as fresh as ever, and with the added magic of haunting words with a beauty of their own. Life has no greater enrichment than the love of poetry. It never loses its charm. That, in ever-varying beauty, is the offering we make in these pages to all who read them.

In reading poetry we should always understand that it is of many different kinds, appealing to widely different minds, and sometimes suiting one mood of our own mind and sometimes another. Great mistakes have been made, even by critics who have had a love of poetry, in refusing the name of poetry to verses that do not happen to suit their own taste at the moment. We should beware how we try

to fix the bounds of poetry too narrowly.

Clever people will sometimes try to rule out simple songs for children, and will say they are not poetry. And those who enjoy simple verse will not trouble to understand what others can enjoy in blank verse and the majestic measures of the greater poets. Both are often looking at poetry too narrowly, for it covers a very wide field. It varies greatly from age to age in its form and spirit, and, when it rings true, moves the hearts of nearly all mankind by some of its strains.

A figure drawn by Raphael to represent poetry.

It is like the wind in its changeful moods, now whispering softly to the leaves, now fanning laziness with a lulling breeze, now blustering along masterfully. Sometimes it pipes shrilly round the cozy home, another day smites the ill-clad deeply with cruel blows, or rages in wild commotion with its companion the trackless sea. None of these moods, gentle, commonplace or terrible, can claim for itself the full and exclusive name of the wind. It is all of them.

And so it is with poetry. The simplest song of childhood may lisp it, sweet and low. The daily life of the home is electric with it. It wings the messages of religion on their way to the human heart. If there are people who show contempt for the poetry of childhood, or for the verses that express the sentiments of family life, or deny the rights of hymns to a generous share in true literature, they are, by such narrow views, proving that they have yet something to learn about true poetry.

It is true that poetry was first of all at home amid scenes where men's hearts were stirred by strong passions. War has always, in its dreadful agony, aroused men to poetic fervor, as have bold adventures, staunch heroism and noble sacrifice.

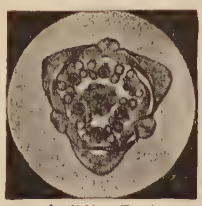
The tumult of men's passions and the mysteries of their fate have inspired poems, powerful and profound. So, also, have all the wonderful charms of nature, changing day by day, and present everywhere; but these fine materials for poetic treatment must not blind us to the simpler forms of poetry that satisfy us too.

One of the objects of the poems that will follow through this book is to broaden the appreciation of true poetry, and avoid slavery to any fashion. For the history of verse is a history of the rise, the reign and the decay of a series of fashions in writing, thinking and feeling. Elizabethan song, the well-drilled writing of Pope's day, and the overflowing sentiment of the first half of the nineteenth century were fashions that left the world weary of their sameness. Each of these movements was popular, and then left the reader tired and seeking a change. First praised to the skies, each became rejected and neglected. Knowing that this injustice is always happening, the wise reader will enjoy what is really good, whether it be simple or great, and will be unmoved by all exaggerations, praise or blame.

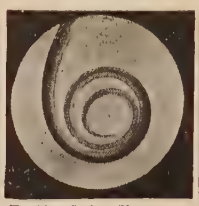
Different kinds of song are of varying value, but each, if it is to be preserved, must have some measure of the pure gold of poetry. It may have the small value of trifling fancy, or the plain worth of faithful description, or the higher stamp of glowing and noble feeling, or the inspiration of lofty thought, and each will appeal to some minds. Happiest are they who can give a due welcome to all. We shall not at first know how to judge between what is good and what is bad. By degrees our ears will attune themselves, and our minds will grasp the difference.

THE NEXT STORY OF LITERATURE IS ON PAGE 299.

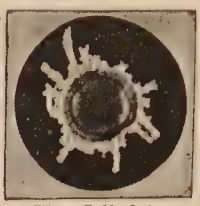
PEEPS THROUGH A MICROSCOPE



A Lily Bud.

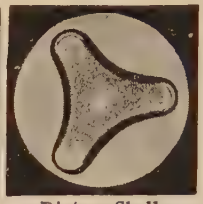


Butterfly's Tongue.

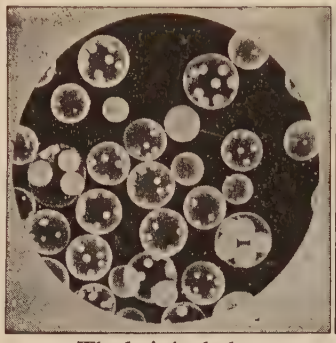


Tiny Jellyfish.

Bee's Tongue.

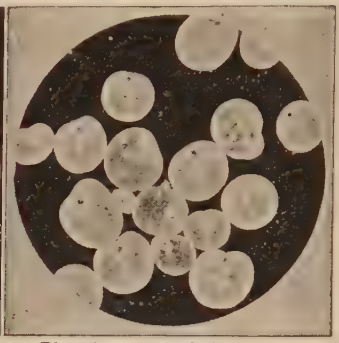


Diatom Shell.



Wheel Animalcules.

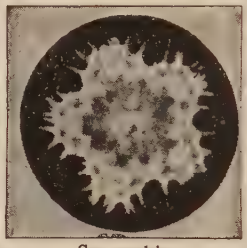
The Ditch Skater.



Phosphorescent Animalcules.

Water Scorpion.

Young Starfish.



Sea-urchin.

A False Scorpion.

Bougainvillæa Hydrozoon.

Head of a Moth.

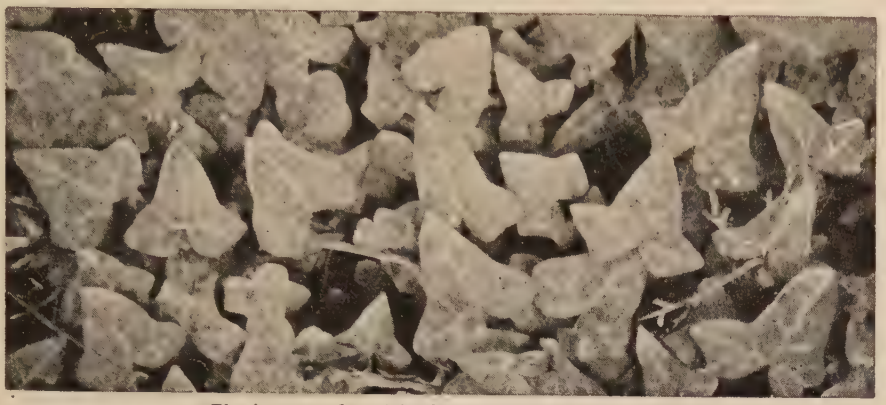
Polysiphon: a Sea Anemone.

Eye of a Bee.

Foraminifera.

Larva of a Bug.

Tongue of a Fly.



The ivy spreads out its leaves to catch the sunshine.

THE FIRST LIVING THINGS

CONTINUED FROM 121

WHEN life first appeared on the earth, there was nothing for it to feed on but lifeless things, like air and salt and water; and the only kind of living creature that can live on such things is the plant.

So we may be quite sure that the first living things were plants, not animals. Now, what the first plants did at first all plants do still. The trees, different in so many ways, living for hundreds of years, and sometimes so large that you could drive four horses abreast through the trunk of one of them, yet feed in just the same way as the first plants that were formed at the bottom of the sea ages ago.

Now let us study the history of plant life and see how plants have grown ever more numerous and more wonderful.

If we dig down very deeply into the earth we find ourselves passing through the first layer to another layer of a different kind, and then to another and another, and so on. We know that these different layers, lying below the one that we live on, were once at the surface and have been covered up; and so, as we dig down and find remains of different kinds of animals and plants, we can tell something as to what the story of life has been on the earth.

You can guess, perhaps, what kind of plants the first ones were. There were no trees or flowers, but there were plants rather like seaweed, and also simple plants of a very humble kind that were close relatives of simple plants of to-day, such as the mushroom and the toadstool. The men who know most about this matter are also sure that near the very beginning of life there were to be found the kinds of plants which we now call microbes, some of which are apt to enter our bodies now and make us ill.

Then, higher up, later in history, and nearer our own days, we find evidence that plant life was becoming richer. This stage is the stage of the ferns, and in those days everything seems to have been just exactly right for the life of ferns, which flourished richly for a long, long time. They became very large, too—giant ferns, such as we cannot see nowadays. The remains of these are now changed into coal, and very useful we find them to-day all over the world.

But all this time there is no sign at all of what are called the higher plants; there were no flowers, or, to use a general sort of word, there were no *flowering plants*. But in time flowering plants

did appear, and they soon made room for themselves.

Many of the kinds of plants that had a good time of it before died out, either altogether or very nearly. The flowering plants were fitter to live in the world that they found around them, and so they succeeded. Just as animals with backbones are the masters of the animal kingdom, so the plants that bear flowers are the masters of the vegetable kingdom.

We can still, indeed, find living plants of lower kinds, which are really not very different from many of the plants found deep down in the earth, which lived at a time when there were no flowering plants at all. But nevertheless the story of the plants is a story that leads steadily up from very small beginnings to the flowering plants, including all the mighty trees.

THE OXYGEN THAT EVERY LIVING THING IN THE WORLD MUST HAVE

And now let us see what we mean when we say that a plant breathes. If we can understand the breathing of a plant, we shall understand the breathing of every living thing, including you and me. When we talk about breathing, we usually think of the way in which our chests move up and down as we draw the air into our lungs and then let it out again.

But a plant has no chest or lungs, and many animals have neither chest nor lungs, yet they must all breathe. There are many different ways of breathing, but they are all really the same at bottom, whether it is the breathing of a plant or a fish or a man.

Wherever living things are to be found, whether under the water or out of the water, there must always be a particular kind of stuff called oxygen. This is a thing we may have never seen or heard of, and yet, whenever we see anything at all, we see through oxygen—because it is part, and the most important part, of what we call air. Oxygen is found in air, and it is also found in water. If a living thing lives in air, it takes oxygen from the air. If it lives in water, it takes the oxygen dissolved in the water.

HOW THE FIRST PLANTS FOUND THEIR FOOD IN WATER

The first plants took oxygen from water because they lived in water, like many plants of to-day, and like crabs and fishes and many other animals. But later plants, like the flowering plants, appeared on the land, just as animals have done, and so they take their oxygen from the air, just as cats and horses and birds and men do.

Breathing is an act that has two parts, and the first of these two parts is this taking-in of oxygen. Every living thing does this, and must die if it ceases to do it. But what is the second half of this act of breathing? Directly we think about it, we shall see that the oxygen which is taken in by breathing must go somewhere, something must happen to it, and the second half of the process of breathing consists simply in giving back oxygen to the air or to the water.

But if that were all, of course there would be no sense in it; it would not be worth doing. But the point is, that while the oxygen comes in alone, "by itself," it always comes out again joined to something else; and it is that which makes all the difference. This something else, though you could hardly believe it, is the same stuff as that which makes coal and diamonds and the writing part of lead pencils, and its name is carbon.

NO LIVING THING CAN GO ON LIVING WITHOUT BREATHING

When the carbon which the oxygen meets in the body of the animal or the plant is joined to the oxygen, it is turned into a new kind of stuff. In fact, it is a kind of gas, the special name for which is carbon dioxid. Every living thing, from its first moment of life to its death, breathes in oxygen and breathes out this stuff which is made of carbon and oxygen, and is called carbon dioxid.

Now, plants must do this because they are living things, and no living thing can continue to live without breathing oxygen. This is the most important substance in nature, so far as life is concerned, for without it life cannot exist. However, as we shall soon see, life must have several other substances also. It is quite easy to prove that a plant must breathe to some extent, because you can suffocate a plant as easily and certainly as you can suffocate an animal. If you keep away all oxygen from an animal, you suffocate it, and it will die, and the same is true of a plant.

Indeed, we may be sure that every living thing will die of suffocation if it does not have enough oxygen all the time, day and night. But a plant needs far less oxygen than an animal, because it breathes

much more slowly, and the curious thing, as we must now see, is that most plants are specially good at doing something which is just the opposite of breathing, something which no animal can do, and which every animal depends upon plants to do for it. The plants that do this wonderful thing that we are going to talk about are all green plants, or, at any rate, if they are not green, like grass, they are brown, like seaweed. But the little difference in color does not matter, for the stuff that makes the seaweed brown is only a cover for the stuff that makes grass green. This stuff is so important that we must think of all plants in the world as divided into two great kinds—those which have this curious green stuff, and those which have not. The first kind we shall call green plants.

Very nearly all plants are green plants, but we have already mentioned one or two that are not—such, for instance, as the mushroom.

The green stuff of all other plants is really one and the same everywhere—even when it is hidden, as in some seaweeds. It has the long name of chlorophyl, but we may just call it leaf-green.

This green stuff is most important because of what it enables the plant to do, and that is what we must now talk about. But we must begin at the beginning—and that beginning is not the green stuff itself, but the sun, the great and glorious sun. By itself the green stuff can do nothing; it is of no use to the plant, and is only a burden to it. Indeed, if plants are cut off from sunlight altogether, they die soon, or, at any rate, lose all the green stuff in them. It is the sun that makes the green stuff in the plant, and the green stuff's only use is to help the plant to profit by the sun.

Now, this is just a tremendous fact, and we should make a very great mistake if we went on to talk about what the green stuff does without making quite sure that we understand what the sun does. Without the sun there would be no life at all upon the earth: *No light, no life.*

The green stuff, then, though necessary for life, is only an instrument, something the light uses to make life. If the sun were to go out, all the green stuff in the world would not help us at all, and all the plants and animals would soon die.

One of the first of all living things—the Seaweed, in the shallow waters where life is supposed to have begun.

Yet, though we have learned how important the sun is, we can still look at the green stuff of the green plant with an interest, since it is the means by which light can produce life.

This green stuff is to be found in other parts of plants besides the leaves. We know that the stalk of a rose is green. But most of the green stuff of plants is found in their leaves, and it is for the sake of the green stuff that leaves exist at all. The leaves of a plant are its tools for using the green stuff. Directly we think of a leaf, we see that it is made in a particular way. It is a flat, thin thing. So much are

leaves flat, thin things that we call other things which are flat and thin "leaves," though they are not parts of a plant at all—the leaves of this book, for instance or the leaves of a table.

Now, there is a very good reason why leaves should be flat and thin. Leaves exist in order to expose as much green stuff as possible to the light. If a leaf were shaped like a ball, only the green stuff on the outside of it, and, indeed, only the green stuff on the side of it which was turned to the sun, could receive the sunlight. All the rest would be in darkness, and that is as good as to say that it would be quite useless.

WHAT THE SUNLIGHT DOES WITH THE GREEN STUFF

Perhaps you never asked yourself before why a leaf is shaped like a leaf; but the question is worth asking, and the answer is that no other shape can be thought of that would be so useful.

We have said that there is something the green stuff does by means of the sunlight; or, better still, there is something which the sunlight does by means of the green stuff. What is it?

If we go back to what we said about the plant's breathing, we shall remember that the plant is surrounded by air. We have seen that this air contains oxygen, which is a gas; but it also contains many other gases, for the air we breathe is nothing else than a mixture of gases. Now, plants, as well as animals, breathe air; but all green plants do also what no animal can do—they eat air. The gas in the air which plants eat, or feed upon, is, curiously enough, the same gas as that which the plant gives out while breathing—carbon dioxid.

THE GREATEST DIFFERENCE OF ALL BETWEEN A PLANT AND AN ANIMAL

The only way in which the plant can get food out of the carbon dioxid is to split it up into the two things of which it is made—carbon and oxygen—to keep the carbon, which is good food, and to give back the oxygen to the air. In the long run, it takes from the air far more carbon than it gives to the air, and builds up this carbon into its own body.

The greatest difference between animals and plants lies in this great power that the plant has of taking carbon dioxid from the air, splitting it up into its carbon and oxygen, giving back the oxygen to the air, and building up the carbon into its own body. As it is building the carbon up into its own body, it fixes the carbon on to other kinds of stuff in such a way as to make things which animals, including ourselves, can eat.

All animals, like all plants, require carbon, but if we were left with nothing but the carbon dioxid in air to get our carbon from, or if we were in a coal-mine with tons of carbon all round us, or if we had tons of lead pencils and millions of diamonds, both made of carbon, we should die of starvation in a few days.

The carbon becomes of use to us only after it has been built up into food substances by the green plant, and if carbon food were not made for animals in this way, the whole animal world would die of starvation.

Let us try to see what it is that happens. Carbon dioxid, as we have seen, is made up of carbon and oxygen, and these two things are joined together so strongly that it needs very great power, used in just the right way and at just the right moment, to separate them. But what men find so difficult is quite easy to the green leaf in the sunlight.

HOW THE GREEN LEAF BEATS THE CLEVEREST MAN IN THE WORLD

The green stuff in the green leaf has no power of itself, and you understand that it is power which is wanted in order to separate things which are tightly joined together. The more tightly a nail is in a wall the harder you must pull to get it out.

Now, there is no power in the world stronger than the power of sunlight. The sunlight which pours down upon the green leaf is power. Clever men can help themselves to far more power than the green leaf can get, but they cannot apply it, and so they can scarcely do what the green leaf does. The green leaf beats the clever men because of the green stuff it contains. It is its green stuff that makes it able to apply some of the sunlight to the business in hand, which is to split up the carbon-dioxid gas of the air into its carbon and oxygen, and to keep the carbon for the use of the plant. This is done without any noise, without any fuss, without any machinery, without great heat, without any waste at all, and without any wear and tear of anything.

And now we know the miracle that is going on in every green leaf in the world.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 329.

WHAT WE SHOULD KNOW OF POETRY

IN this part of our book we shall learn not only the best poems, but many things that we should know about poetry: the various kinds of verse, the differences between poetry of the great poets, the old poetry and the new poetry, and so on. We can understand great poems without knowing all about the different styles of poetry, just as we can understand a steam-engine without knowing the names of all its parts, but we ought to know something about the kind of literature we are reading, and these little lessons in poetry will help us better to understand the full purpose of the poet and the full meaning of the poem.

THE DIFFERENT KINDS OF VERSE

CONTINUED FROM 103

ONLY a very few of the forms of verse need be explained or illustrated here; but these few are important, as you will understand what is meant by them when their names occur in other reading, if you learn them now.

Strictly speaking, a single line of poetry is a verse, but usually any number of lines over two make up what is called a verse; three, four, five, six, even twenty lines, or more, may be a verse.

Verses in poetry are like steps in a stair; they ought to lead on to the end. Each verse should take us a step nearer the end of the poem. Look, for instance, at The Battle of Blenheim, on page 483, and you will see it has eleven verses, each of six lines, and each verse moves the story on a step. In The Wind in a Frolic, on page 228, there are verses of different lengths. Another name for a verse is a stanza.

Short verses of only two lines, or any pair of lines ending with the same rhyme occurring in a longer verse, are called couplets. This is a couplet:

Twinkle, twinkle, little star;
How I wonder what you are!

Any four rhymed lines of poetry form a quatrain. The verses in Queen Mab, page 1138, are quatrains.

We have already learned what lyric poetry is. You will remember that it is chiefly poetry which is suitable for being sung, as it began by men's composing verses to sing to the accompaniment of a harp or lyre. There are, however, many divisions of lyric poetry, and much of it could not be set to music. A very popular form is called the sonnet. This is the most beautiful style of all the smaller poems, but it is not very suitable for poetry that would interest children. A sonnet must have fourteen lines, neither more nor less, divided into eight lines and six. Some of our finest poetry is in the form of these little fourteen-line poems.

The elegy is another form of lyric poetry, and was originally a funeral poem. Hence, any poem about the death of a great man is called an elegy, especially if it mourns for his death. But a solemn poem expressing the sadness of life may also be considered an elegy, like the famous Elegy written in a Country Churchyard, which you will find on page 3337.

The ode, the psalm and the hymn are also other forms of lyric poetry. The ode was originally meant to be sung, and may be called a song of praise addressed to a great man, to a great nation, or to anything living or dead that can be "addressed" in a poetic way; for instance, An Ode to Spring. Odes are not now written to be sung; but, of course, psalms are meant for singing, and so also are hymns.

There are other kinds of lyric poetry. There is the ballad (a story in verse), of which we have an example in The Bailiff's Daughter of Islington; and the idyll (a little picture), like Tennyson's Geraint and Enid in the Idylls of the King.

THE PIED PIPER OF HAMELIN

THERE is a real town in Germany called Hameln, and it is said that a strange man once charmed all its rats away, in the summer of the year 1284. But legend also says he charmed the children away because the mayor and townsmen did not keep their promise to pay him. This old, old story was put into verse by the great poet Robert Browning, and surely no finer children's poem was ever written.

1

HAMELIN Town's in Brunswick,
By famous Hanover city;
The river Weser, deep and wide,
Washes its walls on the southern side.
A pleasanter spot you never spied,
But, when begins my ditty,
Almost five hundred years ago,
To see the townsfolk suffer so
From vermin, was a pity.

2

Rats!
They fought the dogs, and killed the cats,
And bit the babies in the cradles,
And ate the cheese out of the vats,
And licked the soup from the cook's own ladles,
Split open the kegs of salted sprats,
Made nests inside men's Sunday hats,
And even spoiled the women's chats,
By drowning their speaking
With shrieking and squeaking
In fifty different sharps and flats.

3

At last the people in a body
To the Town Hall came flocking:
"'Tis clear," cried they, "our Mayor's a noddy;
And as for our Corporation—shocking
To think we buy gowns lined with ermine
For dolts who can't or won't determine
What's best to rid us of our vermin!
You hope, because you're old and obese,
To find in the furry civic robe ease?
Rouse up, sirs! Give your brains a racking
To find the remedy we're lacking,
Or, sure as fate, we'll send you packing!"
At this the Mayor and Corporation
Quaked with a mighty consternation.

4

An hour they sat in council;
At length the Mayor broke silence:
"For a guilder I'd my ermine gown sell;
I wish I were a mile hence!
It's easy to bid one rack one's brain—
I'm sure my poor head aches again,
I've scratched it so, and all in vain.
Oh, for a trap, a trap, a trap!"
Just as he said this, what should hap
At the chamber door but a gentle tap?
"Bless us!" cried the Mayor, "what's that?"
(With the Corporation as he sat,
Looking little though wondrous fat;
Nor brighter was his eye, nor moister
Than a too-long-opened oyster,
Save when at noon his paunch grew mutinous
For a plate of turtle green and glutinous.)
"Only a scraping of shoes on the mat?
Anything like the sound of a rat
Makes my heart go pit-a-pat!"

5

"Come in!" the Mayor cried, looking bigger:
And in did come the strangest figure!
His queer long coat from heel to head
Was half of yellow, and half of red;
And he himself was tall and thin,
With sharp blue eyes, each like a pin,
And light, loose hair, yet swarthy skin,
No tuft on cheek nor beard on chin,
But lips where smiles went out and in;
There was no guessing his kith and kin:
And nobody could enough admire
The tall man and his quaint attire.
Quoth one: "It's as my great-grandsire,
Starting up at the Trump of Doom's tone,
Had walked this way from his painted tombstone!"

6

He advanced to the council-table:
And, "Please your honours," said he, "I'm able,
By means of a secret charm, to draw
All creatures living beneath the sun,
That creep or swim or fly or run,
And after me so as you never saw:
And I chiefly use my charm
On creatures that do people harm,
The mole and toad and newt and viper;
And people call me the Pied Piper."
(And here they noticed round his neck
A scarf of red and yellow stripe,
To match with his coat of the self-same check;
And at the scarf's end hung a pipe,
And his fingers, they noticed, were ever straying
As if impatient to be playing
Upon his pipe as low it dangled
Over his vesture so old-fangled.)
"Yet," said he, "poor piper as I am,
In Tartary I freed the Cham
Last June, from his huge swarm of gnats;
I eased in Asia the Nizam
Of a monstrous brood of vampire-bats:
And, as for what your brain bewilders,
If I can rid your town of rats,
Will you give me a thousand guilders?"
"One? Fifty thousand!" was the exclamation
Of the astonished Mayor and Corporation.

7

Into the streets the Piper stept,
Smiling first a little smile,
As if he knew what magic slept
In his quiet pipe the while;
Then, like a musical adept,
To blow the pipe his lips he wrinkled,
And green and blue his sharp eyes twinkled
Like a candle flame where salt is sprinkled;
And ere three shrill notes the pipe uttered,
You heard as if an army muttered;
And the muttering grew to a grumbling;

From street to street he piped advancing,
And step for step they followed dancing,

Until they came to the river Weser,
Wherein all plunged and perished.

And the grumbling grew to a mighty rumbling,
As out of the houses the rats came tumbling.
Great rats, small rats, lean rats, brawny rats,
Brown rats, black rats, grey rats, tawny rats,
Grave old plodders, gay young friskers,
Fathers, mothers, uncles, cousins,
Cocking tails and pricking whiskers,
Families by tens and dozens,
Brothers, sisters, husbands, wives—
Followed the Piper for their lives.
From street to street he piped advancing,
And step for step they followed dancing,
Until they came to the river Weser,
Wherein all plunged and perished—
Save one who, stout, as Julius Cæsar,
Swam across and lived to carry
(As the manuscript he cherished)
To Rat-land home his commentary:
Which was, "At the first shrill notes on the pipe,
I heard a sound as of scraping tripe,
And putting apples, wondrous ripe,
Into a cider-press's gripe:
And a moving away of pickle-tub boards,
And a leaving ajar of conserve-cupboards,
And a drawing the corks of train-oil flasks,
And a breaking the hoops of butter-casks:
And it seemed as if a voice
(Sweeter far than by harp or by psaltery
Is breathed) called out, 'Oh rats, rejoice!
The world is grown to one vast drysaltery!
So munch on, crunch on, take your nuncheon,
Breakfast, supper, dinner, luncheon!'
And just as a bulky sugar-puncheon,
All ready staved, like a great sun shone
Glorious scarce an inch before me,
Just as methought it said, 'Come bore me!'—
I found the Weser rolling o'er me."

8

You should have heard the Hamelin people
Ringing the bells till they rocked the steeple;
"Go," cried the Mayor, "and get long poles!
Poke out the nests and block up the holes!
Consult with carpenters and builders,
And leave in our town not even a trace
Of the rats!"—when suddenly, up the face
Of the Piper perked in the market-place,
With a "First, if you please, my thousand guilders!"

9

A thousand guilders! The Mayor looked blue;
So did the Corporation too.
For Council dinners made rare havoc
With claret, moselle, vin-de-grave, hock;
And half the money would replenish
Their cellar's biggest butt with Rhenish.
To pay this sum to a wandering fellow
With a gipsy coat of red and yellow!
"Beside," quoth the Mayor, with a knowing wink,
"Our business was done at the river's brink.
We saw with our eyes the vermin sink,
And what's dead can't come to life, I think.
So, friend, we're not the folks to shrink
From the duty of giving you something to drink,
And a matter of money to put in your poke;
But, as for the guilders, what we spoke
Of them, as you very well know, was in joke,
Beside, our losses have made us thrifty.
A thousand guilders! Come, take fifty!"

10

The Piper's face fell, and he cried:
"No trifling! I can't wait, beside!
I've promised to visit by dinner-time
Bagdad, and accept the prime
Of the head cook's pottage, all he's rich in
For having left, in the Caliph's kitchen,
Of a nest of scorpions no survivor:
With him I proved no bargain driver,
With you, don't think I'll bate a stiver!
And folks who put me in a passion

May find me pipe after another fashion."
"How?" cried the Mayor, "d'ye think I'll brook
Being worse treated than a cook?
Insulted by a lazy ribald
With idle pipe and vesture piebald?
You threaten us, fellow? Do your worst,
Blow your pipe there till you burst!"

11

Once more he stept into the street
And to his lips again
Laid his long pipe of smooth straight cane;
And ere he blew three notes (such sweet
Soft notes as yet musician's cunning
Never gave the enraptured air)
There was a rustling that seemed like a bustling
Of merry crowds justling at pitching and hustling,
Small feet were pattering, wooden shoes clattering,
Little hands clapping, and little tongues chattering;
And, like fowls in a farmyard when barley is scattering,
Out came the children running.
All the little boys and girls,
With rosy cheeks and flaxen curls,
And sparkling eyes and teeth like pearls,
Tripping and skipping, ran merrily after
The wonderful music with shouting and laughter.

12

The Mayor was dumb, and the Council stood
As if they were changed into blocks of wood,
Unable to move a step or cry
To the children merrily skipping by,
Could only follow with the eye
That joyous crowd at the Piper's back.
But how the Mayor was on the rack,
And the wretched Council's bosoms beat,
As the Piper turned from the High Street
To where the Weser rolled its waters
Right in the way of their sons and daughters!
However, he turned from South to West,
And to Koppelburg Hill his steps addressed.
And after him the children pressed;
Great was the joy in every breast.
"He can never cross that mighty top!
He's forced to let the piping drop,
And we shall see our children stop!"
When, lo, as they reached the mountain-side,
A wondrous portal opened wide,
As if a cavern was suddenly hollowed;
And the Piper advanced and the children followed.
And when all were in to the very last,
The door in the mountain-side shut fast.
Did I say all? No! One was lame

Out came the little children running—
All the little boys and girls,
With rosy cheeks and flaxen curls,
And sparkling eyes and teeth like pearls,
Tripping and skipping, ran merrily after
The wonderful music with shouting and laughter.

And could not dance the whole of the way;
And in after years, if you would blame
His sadness, he was used to say:
"It's dull in our town since my playmates left.
I can't forget that I'm bereft
Of all the pleasant sights they see,
Which the Piper also promised me.
For he led us, he said, to a joyous land,
Joining the town and just at hand,
Where waters gushed and fruit-trees grew,
And flowers put forth a fairer hue,
And everything was strange and new.
The sparrows were brighter than peacocks here,
And their dogs outran our fallow deer,
And honey-bees had lost their stings,
And horses were born with eagles' wings:
And just as I became assured
My lame foot would be speedily cured,
The music stopped and I stood still,
And found myself outside the hill,
Left alone against my will,
To go now limping as before,
And never hear of that country more!"

13

Alas, alas for Hamelin!
There came into many a burgher's plate
A text which says, that heaven's gate
Opes to the rich at as easy rate
As the needle's eye takes a camel in!
The Mayor sent East, West, North, and South,
To offer the Piper, by word of mouth,
Wherever it was men's lot to find him,
Silver and gold to his heart's content,
If he'd only return the way he went,
And bring the children behind him.
But when they saw 'twas a lost endeavour,
And Piper and dancers were gone for ever,
They made a decree that lawyers never
Should think their records dated duly
If, after the day of the month and year,
These words did not as well appear:
"And so long after what happened here
On the twenty-second of July,
Thirteen hundred and seventy-six";
And the better in memory to fix
The place of the children's last retreat,
They called it the Pied Piper's Street—
Where any one playing on pipe or tabor
Was sure for the future to lose his labour.
Nor suffered they hostelry or tavern
To shock with mirth a street so solemn,
But opposite the place of the cavern
They wrote the story on a column,
And on the great church window painted
The same, to make the world acquainted
How their children were stolen away;
And there it stands to this very day.
And I must not omit to say
That in Transylvania there's a tribe
Of alien people who ascribe
The outlandish ways and dress
On which their neighbours lay such stress,
To their fathers and mothers having risen
Out of some subterranean prison
Into which they were trepanned
Long time ago in a mighty band
Out of Hamelin town in Brunswick land,
But how or why, they don't understand.

14

So, Willy, let you and me be wipers
Of scores out with all men—especially pipers;
And, whether they pipe us free from rats or from mice,
If we've promised them aught, let us keep our promise!

THE VILLAGE BLACKSMITH

Few poems have had greater popularity than this fine, manly description of simple village life, by Henry Wadsworth Longfellow, the great American poet. The life of a rural village is much the same in all civilized countries, but in America, in the old days, the New England villages were just copies of fine old English villages.

UNDER a spreading chestnut tree
The village smithy stands;
The smith, a mighty man is he,
With large and sinewy hands;
And the muscles of his brawny arms
Are strong as iron bands.

His hair is crisp, and black, and long,
His face is like the tan;
His brow is wet with honest sweat,
He earns whate'er he can;
And looks the whole world in the face,
For he owes not any man.

Week in, week out, from morn till night,
You can hear his bellows blow;
You can hear him swing his heavy sledge,
With measured beat and slow,
Like a sexton ringing the village bell,
When the evening sun is low.

And children coming home from school
Look in at the open door;
They love to see the flaming forge,
And hear the bellows roar,
And catch the burning sparks that fly
Like chaff from a threshing-floor.

He goes on Sunday to the church,
And sits among his boys;
He hears the parson pray and preach,
He hears his daughter's voice
Singing in the village choir,
And it makes his heart rejoice.

It sounds to him like her mother's voice,
Singing in Paradise!
He needs must think of her once more,
How in the grave she lies;
And with his hard, rough hand he wipes
A tear out of his eyes.

Toiling—rejoicing—sorrowing,
Onward through life he goes;
Each morning sees some task begun,
Each evening sees its close;
Something attempted, something done,
Has earned a night's repose.

Thanks, thanks to thee, my worthy friend,
For the lesson thou hast taught!
Thus at the flaming forge of Life
Our fortunes must be wrought;
Thus on its sounding anvil shaped
Each burning deed and thought!

THE WIND IN A FROLIC

By WILLIAM HOWITT

THE wind one morning sprang up from sleep,
Saying, "Now for a frolic! now for a leap!
Now for a madcap galloping chase!
I'll make a commotion in every place!"

SO it swept with a bustle right through a great town,
Cracking the signs and scattering down
Shutters; and whisking, with merciless squalls,
Old women's bonnets and gingerbread stalls.
There never was heard a much lustier shout
As the apples and oranges trundled about;
And the urchins that stand with their thievish eyes
For ever on watch, ran off each with a prize.

THEN away to the field it went blustering and humming,
And the cattle all wondered whatever was coming;
It plucked by the tails the grave matronly cows,
And tossed the colts' manes all over their brows;
Till, offended at such an unusual salute,
They all turned their backs, and stood sulky and mute.

SO on it went capering and playing its pranks,
Whistling with reeds on the broad river's banks,
Puffing the birds as they sat on the spray,
Or the travellers grave on the king's highway.
It was not too nice to hustle the bags
Of the beggar, and flutter his dirty rags.

'TWAS so bold that it feared not to play its joke
With the doctor's wig or the gentleman's cloak.
Through the forest it roared, and cried gaily, "Now,
You sturdy old oaks, I'll make you bow!"
And it made them bow without more ado,
Or it cracked their great branches through and through.

THEN it rushed like a monster on cottage and farm,
Striking their dwellers with sudden alarm;
And they ran out like bees in a midsummer swarm.
There were dames with their kerchiefs tied over their caps,
To see if their poultry were free from mishaps;
The turkeys they gobbled, the geese screamed aloud,
And the hens crept to roost in a terrified crowd;
There was rearing of ladders and logs laying on,
Where the thatch from the roof threatened soon to be gone.

BUT the wind had swept on, and had met in a lane
With a schoolboy, who panted and struggled in vain;
For it tossed him and twirled him, then passed, and he stood
With his hat in a pool and his shoes in the mud.

THEN away went the wind in its holiday glee;
And now it was far on the billowy sea,
And the lordly ships felt its staggering blow,
And the little boats darted to and fro.
But lo! it was night, and it sank to rest
On the sea-birds' rock in the gleaming west;
Laughing to think, in its fearful fun,
How little of mischief it really had done.

The Sanitarium at Saranac Lake.

THE BELOVED PHYSICIAN

CONTINUED FROM 128

IT was cold but very beautiful and quiet in the deep woods that afternoon. The mountains covered with unbroken forest rose steeply from the river, and at their base the valley swept out of sight in gracious waves. A hunter, clad in well-worn corduroys, thick leather boots and a fur cap, had fallen asleep leaning on his gun as he waited for a fox. As he slept he dreamed. Instead of the fox runway where he stood, he saw the forest melt away and the whole mountainside become covered with curiously built houses. As he gazed intently upon them the man saw that they were built inside out, as if the inhabitants lived on the outside.

To-day, if you stood on the spot where the hunter waited through the cold midwinter afternoon, you would see that his dream has come true. Dotted over the mountainside are over thirty small buildings, all of them hemmed with porches greater than themselves. Sidewalks and roads run from point to point in the little colony. In the summer, instead of tracks of unbroken forest, green lawns and flower-beds meet the eye.

Who is it that in so little time has worked this great transformation? None other than the hunter himself, Dr. Edward Livingstone Trudeau, called by his friends "the beloved physician." When he fell asleep over his gun that cold winter day he was not merely a weary sportsman waiting for a wily fox: he was also a very sick man who had come to the Adirondacks merely to spend his last days amid surroundings which he loved. He had nursed a brother who had died from tuberculosis, and because so little was known in those days about the disease Dr. Trudeau had exposed himself to unnecessary risks and so contracted the illness. He was only twenty-five years old, at the beginning of a promising medical career, and happily married, when the blow fell. After some months' stay on Saranac Lake at the headquarters of the famous guide, Paul Smith, Dr. Trudeau gained so much benefit from the beautiful air and restful woods that he returned a second time. This treatment of open air and rest is one that is usually followed now, but in those days it was a new thing. If the patients were ill enough they were kept in bed, and all fresh air was carefully excluded; or if they were well enough to be about, violent exercise, such as horseback riding, was often prescribed. The second summer Dr. Trudeau, against advice,

decided to remain on through the severe winter, although Paul Smith's was then sixty miles from a doctor or a railroad, and entirely cut off from all connection with the outside world.

The Adirondacks were a real hunter's paradise, and every day the doctor followed his favorite sport, which was quite possible without going far from the house. His wife and two children joined him, and the doctor so improved that he began to practice among the Adirondack natives. After four years he moved to Saranac Lake, then a small lumber centre with only a few houses and a sawmill.

A few patients placed themselves under his care, and gradually the number increased. The visitors to the lakes were generally wealthy people, but Dr. Trudeau gave the guides and their families free medical attention, and they were all devoted to him. When the doctor made up his mind to build a sanitarium at Saranac Lake for people of moderate means, the guides found out the piece of land he wanted and by subscription raised the money and gave Dr. Trudeau the deed. Plans for building were at once considered and the doctor, putting his pride in his pocket, began asking his friends, acquaintances and patients for subscriptions toward the expenses. For thirty years he bravely continued to beg money for others, and on many occasions had great pleasure in the generosity of his friends.

This was not done easily and without setbacks. On the contrary, the thirty years were full, for Dr. Trudeau, of uphill and heroic effort, often in the midst of bad health, difficulties, trials and sorrows. Year by year he faced the problem of paying a debt on his sanitarium, because patients were charged a fee that did not cover expenses. Each and every day was lived among people who were often in the saddest condition. Three of his four children died, but he continued bravely in his work. His house and little laboratory were burned down—all his instruments and precious records lost—but he gradually rebuilt.

Besides looking after his patients in the sanitarium, and those who came from the country round or journeyed from far to see him—for his fame grew fast—Dr. Trudeau was occupied constantly with experiments that would help in the fight against the disease. It was very hard to get instruments and apparatus, even in the cities, in those days, and we can imagine what it was in the very heart of the woods. His first laboratory was a little room at Saranac Lake, heated by a wood stove (there was no coal). He had a home-made apparatus, heated by a kerosene lamp, and in this he succeeded in growing the tubercle bacillus, which had been discovered by Koch to be the germ producing disease.

Dr. Trudeau had many curious experiences among his patients. On one occasion at the end of a long day's work he saw a wretched-looking man waiting outside. The doctor was worn out, and it was in no very pleasant tone that he told the patient to enter, yet when he saw how thin and ill the last visitor was, his heart softened. The tramp sat down, put his hands in his pockets and stared at the doctor.

"How did you come here, and what is wrong?" asked the doctor, and his visitor, nothing loth, told a frank tale. He had been sent to a large public hospital, and not liking what he saw, determined to get out. In the ward he heard the doctors and patients speak of Saranac Lake and Dr. Trudeau, and made up his mind to strike out for the sanitarium. He was without a cent, but begged enough to get some little way on his journey. Soon, however, he was observed and put in the poorhouse. He told the authorities his story and his aim, and they bought him a ticket to Saranac. "In that way I finally got here. Now what can you do for me, Doctor?" The doctor collected enough money from some of his patients for the tramp to build a little rough board shanty on a vacant lot. There he slept on a straw bed, and the hotel proprietor gave him scraps from the table so that he lived very contentedly. He stayed for eighteen months and the doctor grew very fond of him.

So the work prospered and spread, and the fame of the delicate doctor grew. Other states, other cities and other individuals followed the plan of Saranac Lake Sanitarium, which was the first of its kind in America to practice the simple principles of fresh air, suitable food and rest. When Dr. Trudeau died, in 1915, he had the satisfaction of knowing that his work marked the raising of the standard in the great fight against the white plague.

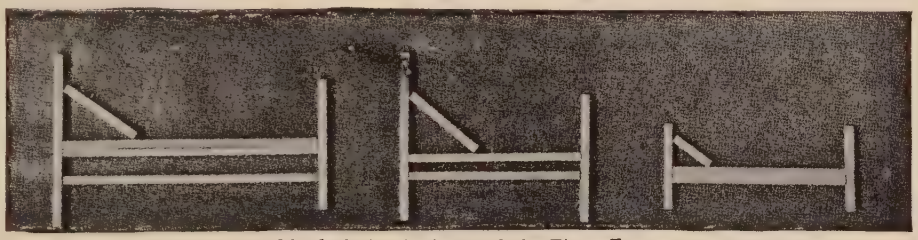
THE NEXT STORY OF GOLDEN DEEDS IS ON PAGE 441.

TELLING STORIES BY MEANS OF STICKS

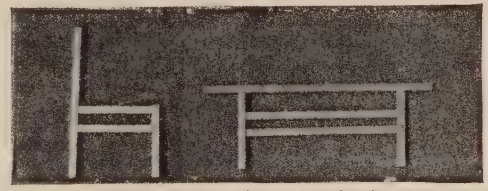
CONTINUED FROM 132

PERHAPS you have heard or read Indian stories which explained how the red men told their tales by means of sticks. Picture-writing, as it was commonly known, has recently become popular with many boys and girls who enjoy telling stories by making their own stick-pictures. While you may make pictures out-of-doors either on the lawn or on the porch with straight twigs and sticks you have collected, as the Indians did, it is possible to have much fun indoors making smaller stick-pictures on the table or floor, even at times when you are unable to go outside either because of stormy weather or because of slight sickness.

One little boy who was recovering from a cold spent several hours making stick-furniture for his stick-house. Pictures of his chair and table are shown in picture 2. Then his sister became so much interested in what he was making that she, too, decided to make stick-pictures, but hers were to illustrate the stories she had been reading. After each one was finished she would ask her brother if he could guess what story she had represented in her stick-pictures. A part of one picture which she made is shown in picture 1. You will have guessed that she was illustrating the story of The Three Bears. Can you make the chairs and other furniture which the three bears used? What other stories can you tell with stick-pictures?



1. The beds in the home of the Three Bears.



2. Table and chair made of sticks.

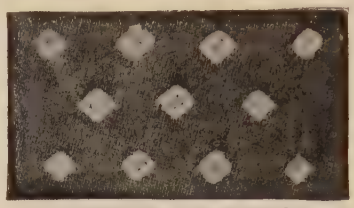
This boy and his sister used square kindergarten sticks which were cut to the desired lengths. However, any long straight sticks, such as burnt matches, toothpicks and Tinker Toys, may be used.

Older children who have to amuse younger brothers and sisters find that this kind of story-telling always delights the little ones. If you have younger children teach them this game of picture-writing.

DECORATING A SCARF BY THE TIED-AND-DYED METHOD

INDIAN women sometimes used the tied-and-dyed method of decorating their clothing. To-day this process is used quite extensively because of its popularity for cotton and silk handkerchiefs, scarfs and artcrafts.

Would you like to dye a scarf by this method? First, secure a suitable piece of plain material, such as China silk or crêpe de chine, several feet of twine and a package of fast dye. Then, holding the piece of material by the centre, draw it down as smooth as possible. Now, about 1 inch down from the centre tightly wrap with the twine several times and tie. Repeat this wrapping of the twine somewhat more than 2 inches down, and then at regular intervals over the garment. When the tying is completed, you should wring the cloth out in cold water before placing it in the prepared bath of dye. After the dyed garment has been allowed to dry, the twine is removed in order that the cloth may be straightened out again.



A design for a dyed scarf.

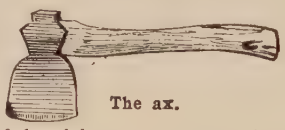
It will be found that the general design of the scarf somewhat resembles the one shown in the picture. After this first experience you may modify the design in various ways to suit the purpose at hand. More elaborate patterns may be made by using needle and thread to run stitches through the cloth to make the shape of the desired design. When the thread is drawn very tightly and wrapped several times with twine, the desired pattern is assured before dyeing.

Indian women very often dyed their blankets in such a manner that the pattern told a story about their tribe. This needed very careful wrapping of the twine and also the use of different color dyes. These dyes were made by women themselves from plants and trees that grew around the encampments. Any girl or boy can make dyes just as the Indians did. Black, red, orange and yellow were the chief colors used, and are still most effective. To get a black dye, put berries, roots and bark of the sumac into a pot with some old iron. Cover with water and boil until a deep black liquid results. The roots and juice of the Squawberry when soaked and boiled give a vivid red. Yellow is made by boiling the inner bark of some oaks or yellow moss that grows on pine trees. Orange is obtained by mixing red and yellow dyes. There are other berries and roots which give other colors, but whoever experiments can obtain surprising results.

THE BOY CARPENTER'S BOX OF TOOLS AND HOW TO MAKE THE BOX IN YOUR OWN HOME

EVERY boy should have a box of tools, and know how to use them. With practice, you may make many things useful and ornamental.

While you will not be able to have as many tools as a proper carpenter, you may, with careful saving and wise spending, have enough to do many useful things which would otherwise have to be sent out to be done.



The ax.

There are, of course, different qualities of tools, and you should purchase the best you can afford. You could get a toy saw for a quarter, or even for less, but you would not be able to do much good with it. You should get a saw that costs not less than one dollar, and if you pay a little more for it, it will be well worth the extra cost. Carpenters usually buy saws costing very much more than this.

The tools you must have are: an ax, a hammer, a saw, chisels, planes, a screwdriver and a gimlet. Let us look at these tools and see how they are used.

The first is the ax, or hatchet. We shall want only a small ax. You may

Using the ax.

The saw.

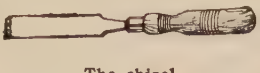
Using the saw.

not have to buy a special ax, as there is usually an ax for chopping wood in any house, and you may be able to borrow this when you require it. The ax is used for splitting wood, as you see. Wood has what is called a *grain,* which is always up the way the tree has grown, and it can be split up the way of the grain, but not *across* the grain. When you wish to cut wood *across* the grain you must use a saw. When the grain of the wood is very regular you can split wood evenly with the ax, but if the grain is twisted you cannot do so. Therefore, even when you want to have the plank of wood cut the way of the grain, it may be necessary to use the saw instead of the ax. There are many saws. The kind you want is a handsaw, say about 14 or 16 inches long. You can use this both for sawing the long way of the grain and across the grain. There are many ways of sawing, but there is only one right way. You must work the saw backward and forward regularly, not rocking it from side to side, or you will cut unevenly; and not jerking it out and in, or you will blunt the saw, and tire yourself very soon. Before beginning to saw, make a pencil-line on the wood where you want to cut it, and make the saw follow the line very carefully. You must have, in addition, a foot rule; a try-square will be useful in marking wood.

The square.

Using the square.

The hammer.



The chisel.

Using the hammer.

Taking out nails.

Using a chisel.

Straightening a bent nail.

The gimlet.

The screwdriver.

The plane.

Using a gimlet.

A hammer is a tool you cannot possibly do without. Its chief use is for driving in nails. Get what is called a claw-hammer. By using the two claws in the way shown in the picture you can draw out nails from wood so as to use them over again. When you have drawn them out you will probably find that they are bent, and that you cannot drive them in again properly. Therefore you must straighten them. Put them on a piece of iron or stone, or on a block of hard wood—not upon anything that must not be damaged—and place the point downward, as in the picture. Then strike the high place with the hammer until the nail is straight. Use new nails wherever you can, but you must begin with the idea that you are going to spend as little money as possible. Chisels are used to cut the wood where an ax or a saw would not be suitable. We use a chisel, for instance, to cut away the wood to make room for a lock on a door, and sometimes before putting on hinges.

We use a gimlet to make holes chiefly when we are going to put in screws. For ordinary driving nails it is not necessary to make holes with the gimlet unless the wood is very hard and likely to split.

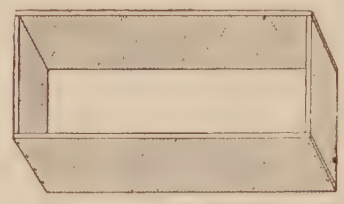
The screwdriver is for putting in screw-nails. It is pressed against the head of the screw-nail with its point in the slot of the turned head and is turned round at the same time.

Using a screwdriver.

Now we come to the plane. If you look at an ordinary wooden fence and then at a door in a house you will notice a great difference in the surface of the wood. The fence will probably be rough, or almost hairy.

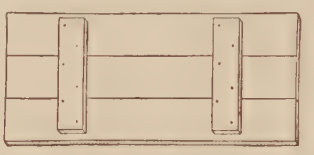
Using the plane.

The reason is that the door has been planed and the fence has not. All wood to which we want to give a smooth surface must be planed. Another reason for planing is that if we paint wood that has not been planed we use much more paint than we should use if the wood had been planed. Wood not planed uses up paint as blotting-paper uses up ink. In using the plane, push it forward on the wood steadily, and press upon it evenly all the time. The edge of the plane-iron, which does the work, must stick out below the bottom of the plane, but not too far. The plane-iron and the chisels must be kept sharp; and you should also have an oil-stone by all means. The stone is called an oil-stone because it is used with a little oil in rubbing the edge of a tool upon it.



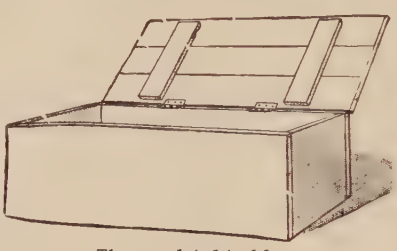
The ends and sides of the box.

Box end and position of bottom.



The lid of the box.

The position of a hinge.



The completed tool-box.

The first thing you might make with your tools is a box in which to keep them. You can no doubt find somewhere an empty soap or sugar box, or you may probably buy one from the grocer for a few cents.

Having got the box, take the sides apart by pulling out the nails. Now measure off two pieces 18 inches long and 6 inches wide. These are for the two sides of our tool-box. Then measure off two other pieces 6 inches by 7 inches to make the ends. Cut out these pieces, plane them until they are good enough, and nail them together so that they look like the top picture, with the end pieces fitted inside the sides.

The total length when nailed up is 18 inches, and the width will now be more than 7 inches—it will be 8 inches if the wood of the sides is ½ inch thick. Now nail on pieces of wood to make the bottom, having cut them out as you did the sides. You may get the bottom in one piece, but if the wood is not wide enough you must nail pieces together.

Now you must make the lid. Take one or more pieces of wood making the same width all together as the bottom. Nail across them, as in the drawing, two pieces that do not go quite to the edge. The lid is now made. You can use it as a lift-off lid or you can put it on with hinges, which you can buy. Fix these on with screw-nails, screwing them to the edge of the lid first. Then chisel away a little of the wood from the back of the box so as to make room for the hinges. You can put a lock on it if you like, and fit inside a tray to hold nails and other small things.

HOW TO MEASURE CORRECTLY IN COOKING

WHEN little girls as well as grown-ups begin to cook, they are often puzzled about the measurements given in recipes.

The very best way to measure cupfuls, or parts thereof, is to use a standard measuring cup. This may be purchased for as little as 10 cents at a five-and-ten-cent store. One side of the cup is graduated, or divided into quarters, and the opposite side into thirds. All one has to do, if a recipe calls for two-thirds of a cup of sugar, is to fill the cup just to that measure.

In most recipes, a cupful means a level cup and not a heaping one. So, when following directions, measure all materials level; that is, fill the cup or spoon heaping full and then level off with a flat knife. When measuring a cup of sugar or flour, sift lightly into the measure, then level off. To measure a half spoonful, fill the spoon and level off, then with a knife divide in half lengthwise—not across the spoon; for a quarter spoonful, divide the half spoonful crossways. Standard measuring spoons may be bought.

We give here also a few weights and measures and what they mean.

16 ounces	= 1 pound
60 drops	= 1 teaspoonful
3 teaspoonfuls	= 1 tablespoonful
4 tablespoonfuls	= ¼ gill; ¼ cupful
16 tablespoonfuls	= 1 cupful
2 gills	= 1 cupful
2 cupfuls	= 1 pint
2 cupfuls granulated sugar	= 1 pound
2 cupfuls butter	= 1 pound
2 pints	= 1 quart
4 quarts	= 1 gallon
2 tablespoonfuls salt	= 1 ounce
2 tablespoonfuls sugar	= 1 ounce
4 tablespoonfuls flour	= 1 ounce
1 tablespoonful liquid	= ½ ounce
1 square chocolate	= 1 ounce
3½ cupfuls confectioner's sugar	= 1 pound
2 2-3 cupfuls oatmeal	= 1 pound
2 2-3 cupfuls brown sugar	= 1 pound
1 quart flour	= 1 pound
10 small eggs	= 1 pound
9 medium eggs	= 1 pound
8 large eggs	= 1 pound

In measuring flour, always sift the flour first and *then* measure.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 335.

Our face to the sun in summer. Our face to the sun in winter.

THREE WAYS THE EARTH MOVES

CONTINUED FROM 144

THE first thing we are inclined to say when we are told the earth moves is that we do not feel it moving, but the answer to that is easy.

When you are in a train in a station, you sometimes cannot tell whether the train is moving or not, except, perhaps, by looking at another train standing at the other platform, and sometimes you think your train is moving, until you see that the platform is quite still. It was the moving of the other train that made you think *your* train was moving.

So it proves nothing to say that we do not feel the earth moving with us. If you are traveling in a train or on a boat or in a balloon or on this great earth, you have only two ways of judging whether you are moving or not. One is by feeling the movement under you, and the other by noticing that things outside seem to be moving past you.

Now, certainly we cannot feel the earth move under us, but this is simply because the movement is so smooth. The best proof of the smoothness of the earth's motion is that no one has ever felt it moving. Sometimes a little bit of the outside of it moves by itself, and then people feel it. That is called an earthquake, and is quite different. No one has ever felt the movement of the earth as a whole.

What would happen if the earth suddenly stopped moving? If suddenly it *did* stop moving, as a bus pulls up suddenly, or as you pull your arm up quickly when you throw a ball, what would happen to us? When a bus stops suddenly all the passengers are jerked forward. The earth is going so fast that if it were suddenly to stop moving all the loose things on it, and many of the fixed things on it, would be hurled off of it. Indeed, the shock would render the earth red-hot and probably tear it to pieces. But nothing except collision with a sun or a planet could stop the motion of the earth, and there seems to be no likelihood of such a collision's occurring. The earth is likely to rush on smoothly for thousands and thousands of years.

If you cannot *feel* that the thing you are traveling on is moving, there is only one way of finding out that it is moving, and that is by looking at things outside it and seeing what they seem to do. Clever men have been doing this for ages, and there seemed to be no doubt at all about what they saw. As we have already seen, when we look up at the sky we find the sun, for instance, seeming to travel once round the earth every day.

But, as a boy in a train can some-

times make a mistake and think that the other train is moving when it is really *his* train that moves, so all the men who thought they saw the sun moving across the sky were wrong. It was not the sun that was moving, but the earth. We still talk of the sun's rising and setting, and no doubt men will go on doing so for ages, but the sun does not rise and set. It is simply the earth that is spinning round like a top. If you have a globe, a little round model of the world, you can easily learn from it something about the first kind of movement of the earth.

THE TURNING OF THE EARTH THROUGH THE SUNLIGHT INTO SHADOW

There are at least three different movements of the earth, and we must look at them all. The one we shall begin with explains why the sun seems to rise every morning in the east and to set every evening in the west. Take your little globe—if you have not a globe a rubber ball or an orange will do—and hold it in your hand opposite a lighted candle in a room where everything else is dark. The side of the ball next to the candle will be lit up, and the side away from the candle will be dark. Put a spot of ink on the ball and call it your house, and hold the ball so that the spot is opposite the candle. Now turn the ball slowly round, and the spot will travel round until at last it loses the light of the candle. Then, as you go on turning, the spot will become lit up again.

The candle stands for the sun, and when the spot is just opposite the candle, that is *midday*. Then, as the ball goes on turning, the spot loses the candle-light; that is to say, the sun sets, and it is night. Then the spot turns to the side where the ball is lit up, and if you were on that spot you would say the sun had risen once more.

WHAT WOULD HAPPEN IF THE EARTH WERE TO STOP MOVING

Imagine the ball to be the earth and the spot your house, and you will begin to understand how day and night occur. It is night because your side of the earth passes out of the sunlight; it is day because it comes into the sunlight again.

Think what it would be like if it were always day, or if it were always night. If the earth were not forever spinning round and round like a top, and if it were quite still, one half of it would always be in daylight, while the other would have an endless night. So long as you hold your ball or globe or orange still, one half of it must be next the candle, and the other half away from it.

What do you think would happen to us all if the earth were to stop moving round and round, and if it slowed down quietly like a top so as not to jerk us all off? Suppose it stopped with our part facing the sun, we should say, "The sun is standing still in the heavens." The lamplighters would do their work at the ordinary time. People would say, "It is a very bright evening," and then they would say, "Whatever has happened?" There would be no night at all; it would go on being day. Do you think that all the people from the other side of the world, where it was night all the time, would jump into their ships and come over to our side so as to see the sun again? Probably they would, but before long we should all be very glad to get on to the dark side of the earth—for a time, at any rate. The best thing for us is that the earth should go on spinning as it spins now, and that we should have the day to be awake in and the night for sleep.

THE BEES THAT WERE DECEIVED AND DIED FROM OVERWORK

There is a story of some bees that worked hard all day, and went to rest. Then someone lit a brilliant electric light and brought a sham day back to them. The bees started work again until the light was put out, and then, soon after, the sun rose, and they started again. At the end of that day they were all worn out, and died from overwork. But the natural and proper thing for bees—and for men, too, who live on a great spinning top—is to be awake when the part of the top they are on is facing the sun, and to sleep when it is turned the other way.

But the spinning of the earth, which gives us night and day, is by no means the earth's only movement. You will have noticed, when spinning a top, that sometimes it stands in one place and spins there, but sometimes it moves along the table. When this happens the top is moving in *two ways at once*.

It is spinning on itself, so to speak, and also being moved as a whole from one place to another. The earth is like the top. All the time the earth is spinning on itself it is also moving as a whole, as the top does when it moves along the table. We do not feel this, but it is also an im-

ROUND AND ROUND THE SEASONS COME

SPRING

SUMMER

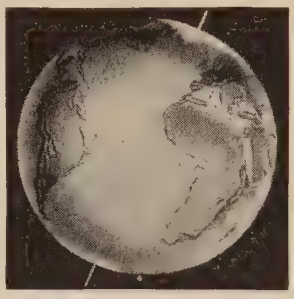
AUTUMN

WINTER

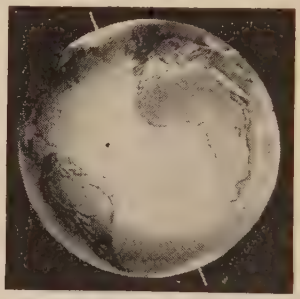
portant movement of the earth, even though its results are not so startling as the day and night which the spinning movement gives us.

There is no need now to ask, What holds the earth up? We know that the earth is not supported by anything, but flies through space without stopping from one year's end to another.

A year, you know, is a real thing—not like a week. We may think a week is a real thing because Sunday always comes back every seven days, and so do the other days. But we might just as well miss out Wednesday, Thursday, Friday and Saturday, and make the week three days. Long ago men agreed to call seven days a week, and we do so still; but a week is an *artificial* thing; a day is a *natural* thing, and so is a year. We say a week is an artificial thing because nothing in nature makes it; but a day is a natural thing because a great fact in nature makes it, that fact being the spinning of the earth. A year is also a natural thing, because it is made by this second kind of movement of the earth, which is like the movement of the top *along* the table.



How the earth is tilted to-day.



How the earth will be tilted in 12,000 years.

Let us think of a spinning ball now, instead of a spinning top. We know very well that a ball can spin as it goes along, because we can set it spinning on a table, and as it spins it will also run in one direction or another. What direction does the earth move in, then? We have already seen that day and night, which never fail us, are due to its spinning. Now, on the whole, one night is just about as dark as another, and one day as bright as another—that is, if we think of all the days and nights we can remember.

This means that the earth does not get much nearer to the sun or go much farther from it. It stays at about the same distance, yet it always goes moving onward, onward, onward. That means that it *must go round the sun.* If you tied a string from your ball to your candlestick you could make the ball fly round the candle, only it would not be so easy to make the ball spin as it flew.

If you could make the ball spin, and if you could make it spin on itself about 365 times while it was going right round the candle once, that would be what the earth is doing. The earth is always flying round the sun, and if you made a mark at some point, and then waited until the earth came back to that point after going round the sun once, the time the earth took in its journey would be a year, and during that journey round the sun the earth would have spun round on itself 365 times. Really, it is about 365 and a quarter times, and it is so that we may not forget that quarter that every four years we have what we call leap year, making the year 366 days long by giving February 29 instead of 28.

In its course round the sun, however, the earth does not move in a perfect circle, but in a path which is slightly oval, so that it is sometimes a little nearer the sun and sometimes a little farther away. Nor does it always move at exactly the same speed, but quickens as it nears the sun. This is necessary, for if the earth moved no more quickly when near the sun than when farther away, it would be drawn into the sun; and if it moved as quickly when farther away as when near, it would fly away from the sun altogether.

We have mentioned two of the three great motions of the earth—its spinning on its own axis and its revolution round the sun—and we now come to its third motion, which may be described as a wobble—such a wobble as a top makes.

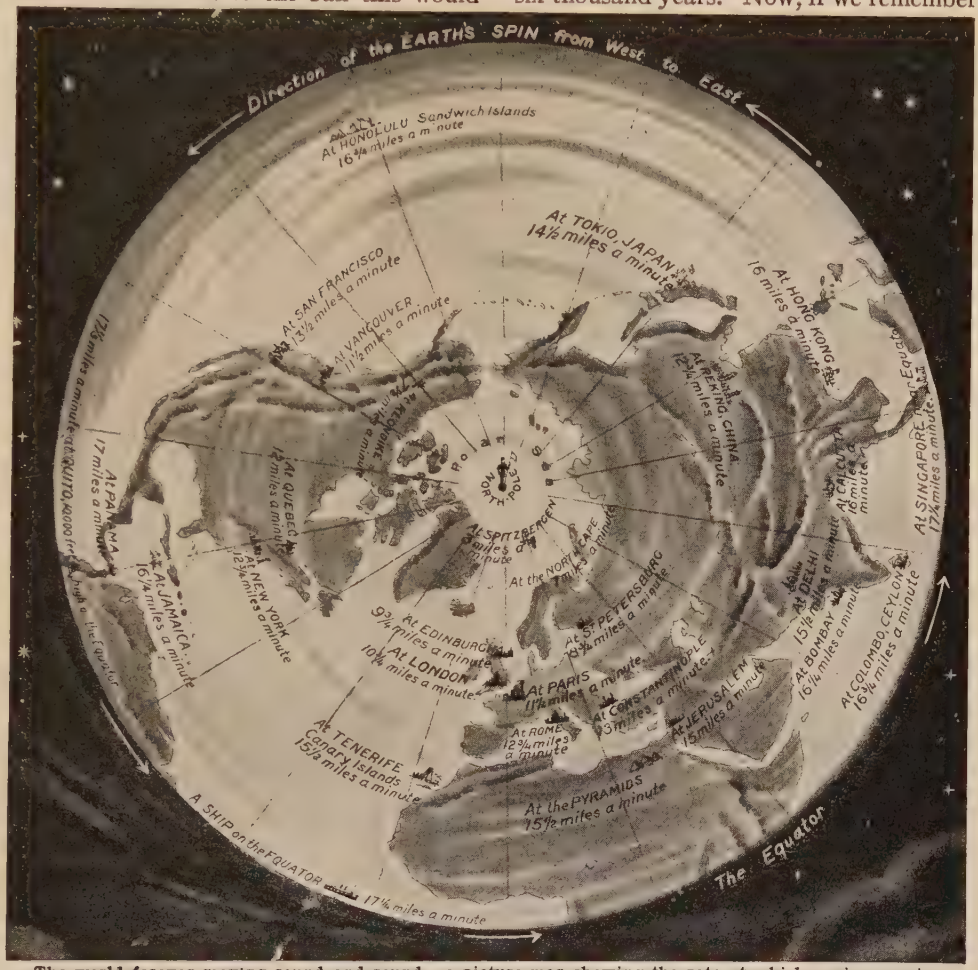
If you have a globe, you must have noticed that it is not set squarely in its frame. The North Pole is not at the very top and the South Pole at the bottom, but the globe is tilted. This tilting of the earth as it goes round the sun is very important indeed, for it is responsible for the seasons. It means that the northern half of the earth will get the sun's rays pouring very directly down upon it during

one part of the year, which we call summer, but not so directly during the other part of the year, the winter. Study the picture at the top of this story and you will understand.

That is why summer is hot and winter cold. You might perhaps think that when the earth was nearer the sun this would make summer; but, as a matter of fact, the earth is nearer the sun during our winter. Our winter, also, is summer for the Australians, who live on the opposite side of the world, and when we have summer they have winter. So the distance of the earth from the sun has nothing to do with the seasons, and they are due, as we have said, entirely to the fact that the earth is tilted.

Now, the wobbling we have mentioned has to do with this tilting of the earth's axis. The earth is not always tilted just the same amount, but for thousands of years it becomes rather more tilted than it was, and then for thousands of years rather less tilted. To be sure, this wobbling of the earth is a very slow affair. Indeed, one wobble takes nearly twenty-six thousand years. Now, if we remember that the seasons are due to the tilting of the earth, we may understand how it is that at one part of the wobble the earth may be so much tilted that the winter, for instance, in its northern half will be very long and cold. This helps us to explain the times when all the northern part was covered with ice.

These, then, are the three chief motions of the earth—its spin, its revolution round the sun and its wobbling tilt.


Direction of the EARTH'S SPIN from West to East
At HONOLULU Sandwich Islands 16¾ miles a minute
At TOKIO, JAPAN 14½ miles a minute
At HONG KONG 16 miles a minute
At SINGAPORE 17¼ miles a minute
At CALCUTTA 15¾ miles a minute
At PEKING, CHINA 15¾ miles a minute
At SAN FRANCISCO 13½ miles a minute
At VANCOUVER 11½ miles a minute
At MONTREAL 9¾ miles a minute
At QUEBEC 9¾ miles a minute
At NEW YORK 12¾ miles a minute
At PANAMA 17 miles a minute
At QUITO, 9000 ft. high
At JAMAICA 16¼ miles a minute
At SPITZBERGEN 3 miles a minute
At the NORTH CAPE 7 miles a minute
At ST. PETERSBURG 13¾ miles a minute
At EDINBURGH 9¾ miles a minute
At LONDON 10¼ miles a minute
At PARIS 11¼ miles a minute
At CONSTANTINOPLE 13 miles a minute
At JERUSALEM 15 miles a minute
At DELHI 15½ miles a minute
At BOMBAY 16¼ miles a minute
At COLOMBO, CEYLON 16¼ miles a minute
At ROME 12¾ miles a minute
At TENERIFE Canary Islands 15½ miles a minute
At the PYRAMIDS 15⅛ miles a minute
A SHIP on the EQUATOR 17¼ miles a minute
The Equator
NORTH POLE
SOUTH POLE

The world forever moving round and round—a picture-map showing the rate at which various parts of it travel round its axis.

To be sure, this wobbling of the earth is a very slow affair. Indeed, one wobble takes nearly twenty-six thousand years. Now, if we remember that the seasons are due to the tilting of the earth, we may understand how it is that at one part of the wobble the earth may be so much tilted that the winter, for instance, in its northern half will be very long and cold. This helps us to explain the times when all the northern part was covered with ice.

These, then, are the three chief motions of the earth—its spin, its revolution round the sun and its wobbling tilt.

THE NEXT STORY OF THE EARTH IS ON PAGE 385.

How the Vikings came to America five hundred years before Columbus.

The first landing of Columbus in the New World.

THE STORY OF THE EXPLORERS OF NORTH AMERICA

ON another page of this volume you read of the voyages of Christopher Columbus, who is generally called the discoverer of America. That is true, for though America had been discovered before, the knowledge had been lost, and only recently have we learned the story of voyages made five hundred years before Columbus, in his three little ships, sailed into the unknown sea. It was just as wonderful a thing as if it had never been done before, for it seems sure that Columbus never heard of the earlier voyages. After Columbus, came other explorers, Spanish, Portuguese, French, English and Dutch, and we shall read of them and their discoveries in the following pages.

EXPLORERS OF NORTH AMERICA

CONTINUED FROM 165

JUST before the year 1000, the Norsemen, or Northmen, as the inhabitants of Norway, Sweden and Denmark were called, were the most skilful and daring sailors of the world. Years before, they had conquered a part of Russia and of France, had sailed into the harbor of Constantinople, and at the time of which we speak were soon to conquer England. These strong, blue-eyed, yellow- or red-haired men, wearing on their helmets the wings of birds or the horns of beasts, drove their dragon boats into almost every harbor in Europe, and the people in the churches prayed to be delivered from the fury of the Northmen.

LEIF ERICSON, THE MAN WHO DISCOVERED AMERICA

Old manuscripts which have been found tell of the discovery of Greenland in the year 876 or 877 and of the founding of a colony there in 985 or 986 by Eric the Red, who went over from Iceland. This colony lasted more than 400 years, and the ruins may be seen to-day. Stories of an unknown land to the west came to them, and in the year 1000, Leif, the son of Eric the Red, with thirty-five men sailed to find it. The journey was not long as you will see if you look at a map of the northern part of the world. Another account says that he was on his way to Greenland to carry Christianity there, but was blown out of his way. The stories do not agree in every particular, but we shall try to make them clear.

One story says that Leif visited an island, probably Newfoundland, which he called Helluland or Flatstone Land. Others say that a later explorer gave this name to Labrador. Leif is thought next to have visited Nova Scotia or Newfoundland, which he called Markland, or Woodland. At any rate he finally landed somewhere on the coast of Massachusetts or Nova Scotia, which he called Vinland, because there were so many "wineberries" to be seen. He probably meant cranberries, as his description of the way they grew shows. He spent the winter there, loaded the vessel with timber, and returned to Greenland to tell his story. Several other voyages were made to get timber, which was scarce in Greenland.

A rich man named Thorfinn Karlsefni, who had married Leif's sister, with three ships and one hundred and sixty men founded a colony somewhere on the coast soon after, and here his son Snorro was born, the first white child born in America. From this boy some of the most distinguished men in Iceland, Norway and Denmark were descended. The Indians, whom they called "skraelings," or inferior men, made trouble, however, and after three years the colony was given up. Just where this settlement was we do not know, for though men have searched

for signs of it, they have not been found. A few more voyages were made to get timber, but as there was no printing in those days, very few men knew about the land and the story was forgotten.

THE ENGLISH ALSO TRIED TO FIND A NEW WAY TO ASIA

We learned in another place that Columbus did not know that he had discovered a new land, but died thinking he had reached Asia. Now Henry VII of England was one of the kings who had refused to help Columbus to make his voyage. When the news came that Columbus had succeeded, King Henry was very much vexed that he had not gained the honor for himself and for England. So when a sea-captain named John Cabot, also born in the city of Genoa, asked permission in 1496 to make a voyage for England, it was granted at once. Cabot sailed the next year in a tiny boat with a crew of only eighteen men, and landed somewhere on the coast of Labrador or Cape Breton Island, June 24, 1497. The king was pleased, and gave Cabot ten pounds as a reward.

The next year Cabot made another voyage and sailed along the coast of North America, perhaps down to Chesapeake Bay, but found no gold, no precious stones, no silks and no ivory. There seemed to be little profit in such voyages, and therefore the English paid no more attention to the matter for a long time. Later they claimed all of North America because they said that Cabot had been the first European to see the continent, for the voyages of the Northmen had been forgotten long before.

HOW AMERICA WAS GIVEN ITS PRESENT NAME

When Columbus made his first voyage, two of his three little ships were commanded by two brothers named Pinzon. One of these is said to have sailed again in 1497 and to have gone around the West Indies and up the Atlantic coast, probably as far as Chesapeake Bay. With him sailed Americus Vespucius, who told in a letter to one of his friends the wonderful things that he saw. Both Pinzon and Vespucius made other voyages, but Vespucius entered the service of Portugal and claimed that he had explored the coast of Brazil in 1501. Then he sailed southward until he reached the island of South Georgia, further south than any man had ever been before. Here the cold and floating ice drove him back.

When he went back to Europe he wrote a little pamphlet saying that these lands which he had seen were not a part of Asia but were a new world. This made a great noise in Europe, and finally a professor in a little German college said that this "fourth part" of the world which Americus Vespucius spoke of ought to be called America in his honor. People before knew of Europe, Asia and Africa. So they called the new world the fourth part. Everybody agreed, and soon the name was seen on all the maps. First the name America was given only to Brazil, then to South America, and then to all the New World.

Next Portugal sent out an expedition under Gaspar Corte-Real, a slave trader. He made two voyages to Greenland and Labrador, in 1500 and 1501, but his own ship went down, and his brother, who went to find him, was drowned also.

AN OLD MAN WHO WANTED TO BE YOUNG AGAIN

A soldier of Spain named Ponce de Leon was made governor of Porto Rico. Here he founded the city of San Juan in 1511. He was old, and wounds which he had received in the wars pained him all the time. The natives told him that on an island not far away was a wonderful fountain of youth. Anyone who drank of the waters would be made young and strong again, no matter how old and sick he was. So he got permission from the King of Spain to hunt for this wonderful spring, and sailed away with a few men in three little ships.

On Easter Day, in 1513, he reached land which he called Florida, which means flowery. He searched everywhere for the magic fountain, drinking from every spring he found, but he remained old and his wounds still pained him. Afterward he returned to Florida, in 1521, to plant a colony of which he should be governor. But an Indian shot him in the thigh with a poisoned arrow, and the heartbroken old man returned to Cuba to die.

The same year that Ponce de Leon found Florida, another Spaniard, named Balboa, landed on the Isthmus of Panama, or Darien, as it used to be called, not very far from where the great canal has been dug, crossed it, and saw the great Pacific Ocean. Wading into it, we are told, carrying the flag of Spain in one

THE NORSEMEN AND THEIR SHIPS

Here we see the dragon ships driven by sail and oars in which the Norsemen dared the waves. In such a ship Leif, the son of Eric, crossed the Atlantic more than 900 years ago when he came to America. Some had as many as thirty-two oars, each pulled by a strong man, who could also fight when necessary. Not very long ago one of these old ships was dug up, and is now in a museum.

The Norsemen were as brave on land as on sea. They did not fear death, for they thought that brave warriors would be taken to Valhalla, where they might fight and hunt and feast for ages. Every night wounds received during the day would heal, and they would be ready for fresh adventures.

hand and a sword in the other, he declared the ocean and all the lands which its waters touched belonged to Spain forever.

CORTES, WHO CONQUERED MEXICO AND FOUND MUCH GOLD

But the most important of the Spanish explorers was Hernando Cortes, a soldier, who made a large fortune in Cuba. In 1519 he led a force to conquer Mexico, and built the town of Vera Cruz. The inhabitants of Mexico that he saw were Indians called Aztecs who were partly civilized. They had tools and weapons of bronze, but they did not know the use of iron. They built great cities, and had mines of gold and silver, but they thought that the ships were great white birds that had come down from the sky and the white-skinned Spaniards were gods who had come to take the country. If you will read General Lew Wallace's book called The Fair God, you can find more about what they thought and what happened to them.

The ruler of the country was called the Montezuma. He sent presents to Cortes, but said that the road to his capital was so bad that Cortes ought not to try to come to visit him. But Cortes destroyed the ships so that his men could not get back and marched into the country. Though the Indians feared him, they tried to fight him, and one terrible battle lasted two days. There were fewer than five hundred white men in Cortes' army and there were many thousand natives, but the cannon, the guns and the horses were too much for the Indians.

THE WHITE MEN CONQUER MEXICO AT LAST

Then they attacked at night, thinking that if the Spaniards were children of the sun, they would have no power when the sun had gone away. But they found that the Spaniards could fight as well by night as by day, and Cortes marched on until he reached the City of Mexico. The Montezuma sent four cartloads of gold to Cortes and begged him to go away. Soon he captured the Montezuma, but the Aztecs attacked the Spaniards while Cortes was away, and when the Montezuma attempted to make peace, wounded him so that he died. Then Cortes conquered the country and sent many expeditions into what is now the United States. We shall hear more of them on the following pages.

HERNANDO DE SOTO AND THE MISSISSIPPI RIVER

Another famous explorer was Hernando de Soto, who had helped to conquer Peru. When he returned to Spain the king made him governor of Cuba and gave permission to conquer Florida. He landed in 1539 with five hundred and seventy men and two hundred and twenty-three horses, and marched into the country. De Soto treated the Indians very cruelly and made many of them march with him wearing iron chains around their necks. There were no roads, and as the Spaniards were crossing streams or swamps, the Indians would attack them. The Spaniards were not good hunters, and often they had little meat.

To get rid of them the Indians said that there was much gold further north, in what is now Georgia, but they could not find it and the Indians fought them all the time. In one great battle they killed a hundred and seventy men. De Soto wandered far, but found no gold. His men begged him to turn back but he refused, and after much toil and trouble reached the Mississippi River near where the city of Memphis now stands, in 1541. They thought they were the first white men to see this great stream, but we know now that another Spaniard, named Pineda, had sailed into it from the Gulf of Mexico in 1519, and that Narvaez and Cabeza de Vaca had crossed it in 1528. De Soto and his men were very much amazed at its size. Finally they made boats and crossed it. They wandered along the west bank, but still could find no gold. At last the brave but cruel commander died of a fever. His companions feared to let the Indians know that he was dead, and so one night they buried him in the great river and told the Indians that he had gone to visit in the sky for a time. They then built rude boats, floated downstream, and some of them at last reached the Spanish settlement in Mexico.

OTHER SPANISH EXPLORERS; THE OLDEST TOWN IN THE UNITED STATES

As yet there was not a single permanent settlement in what is now the United States, though Spaniards had explored all of the southern part of the country. Coronado, in 1540, had gone north from Mexico to find several rich cities that he had heard of. He did not find any cities except Indian villages, but in the country

FAMOUS EXPLORERS OF AMERICA

CORTES

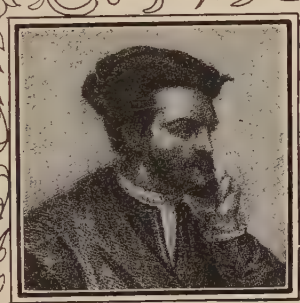
BALBOA

DE SOTO

DRAKE

RALEIGH

HUDSON



CARTIER

CHAMPLAIN

LA SALLE

Three of these explorers are Spanish, three are English and three are French. Cortes conquered Mexico, Balboa discovered the Pacific Ocean, and De Soto reached the Mississippi River. Sir Francis Drake and Sir Walter Raleigh were great favorites of Queen Elizabeth. Henry Hudson, though an Englishman, was in the Dutch service when he sailed into the Hudson River. Cartier, Champlain and La Salle explored the St. Lawrence and the Mississippi, ever hoping to plant the flag of France.

which he called Quivira (possibly Kansas) he told of seeing strange "crook-backed cows." These, as you can guess, were our American buffalo. Finally Menendez, in 1565, founded the town of St. Augustine in Florida, which is therefore the oldest town in the United States. Another Spanish party founded Santa Fé in New Mexico about 1605, or a little earlier, the second oldest town.

Now we shall leave the Spaniards for a time and see what other nations did. Though it was found that the new country was not Asia, it was believed for a long time that it was narrow and that there was a "northwest passage" through the land by which Asia might be reached. The French king sent Verrazano, an Italian sailor, to search for this passage in 1524. He reached the coast probably about North Carolina, and sailed along the coast, perhaps to Nova Scotia. It is almost certain that he was the first white man to sail into New York harbor and to see the Hudson River, but he attempted no settlement. A statue of him stands in a little park called the Battery which is at the very point of Manhattan Island. The French at this time were more interested in capturing Spanish ships loaded with gold and silver, which they had forced the helpless Indians to get for them, than in founding colonies.

CAPTAIN JACQUES CARTIER, THE SAILOR OF ST. MALO

Captain Jacques Cartier, of St. Malo, is one of the principal French explorers. He sailed into the Gulf of St. Lawrence in 1534 and claimed the country for the King of France, setting up a great cross with the words: VIVE LE ROY DE FRANCE. The next year he came again, and sailed up the river until he saw a mountain which he called Mont Royal, which gave the name to Montreal. He spent the winter in Canada, and his men suffered severely from disease until the Indians showed him how to make a tea of the leaves and young branches of the white spruce, which cured them. Cartier came out to Canada again in 1541 and spent another winter near Quebec.

THE SPANISH AND THE FRENCH COME TO BLOWS IN FLORIDA

There was also, about this time, civil war in France on account of differences in religion. Those who adopted the reformed faith were called Huguenots, and there was bitter war between them and those who held the old faith. Some leaders of the Huguenots tried to found a colony in the New World where they would not be disturbed because of religion. They began with thirty men at Port Royal, in what is now South Carolina, in 1562, but they nearly starved, and left.

Two years later a fort called Carolina was built in Florida. At first food was very scarce and the colonists were forced to eat grass, roots and even snakes. Many more men, women and children came out, and leaders hoped that the settlement was strong enough to grow. But the Spaniards claimed the country, and Menendez, who founded St. Augustine, of which you have read above, surprised the French fort and killed everyone he found, about seven hundred in all. Menendez thought that he was right in killing these men and breaking up the settlement. They were enemies to his country and to his religion.

A few of the settlers escaped and, after suffering many hardships, reached France, and told their story. The King of France demanded that Philip II punish Menendez for his act, but the Spaniard said that the settlement was where it had no right to be, as the country belonged to Spain. France was afraid to attempt to punish the Spanish leader, and did not try to make any more settlements in Florida.

There is a story, which may be true, that a French gentleman, Dominique de Gourgues, determined to get revenge for his countrymen. It is said that he fitted out three ships in 1657. With them he sailed and captured the Spanish garrison which had been left in Fort Carolina, and killed every one of them.

HOW CHAMPLAIN MADE A MISTAKE WHICH LOST AMERICA

The most important of all the French explorers was Samuel de Champlain, the "Father of New France." He was a man that every one of you would have liked. He had been a good soldier, a fine sailor, and now he made up his mind to help France to gain a part of the New World. He made two voyages in order to get knowledge, and then in 1608 led a party and founded what is now the great city of Quebec in Canada.

Now he made a great mistake which many years afterward caused the French to lose all the land they had in America. He had heard of a great lake in the south

THE FIRST SIGHT OF WHITE MEN

When the Indians first saw the whites they were generally friendly. Here we see one offering a fish, but his less brave companions remain on the edge of the forest, ready to fly if the whites offer harm.

When Henry Hudson in the Half Moon sailed up the great river now called by his name the Indians in their canoes visited him, above Manhattan Island, but the noise of firearms frightened them very much.

and wished to see it. Some Indians who lived near him were going to fight the Indians who lived near the lake, and Champlain and two companions joined them. Finally they reached the great lake, which is now called Lake Champlain. They paddled on this until they met a large band of Indians near Ticonderoga. When the battle began, the Indians with Champlain would have been defeated if he had not fired his gun and killed some of the bravest war chiefs of the other side. The strange Indians had never seen a white man or heard a gun. Frightened at the white men's power, they ran away and many were killed.

THE INDIANS WHO NEVER FORGOT A DISGRACE

These Indians were members of the Mohawk tribe, which was one of the Five Nations. They told the other tribes about the disgrace which had come to them because of the French, and all the Five Nations swore undying hatred toward that nation. Many years afterward, when France and England were at war, the Five Nations, now become the Six Nations, would not allow the French to come down the Hudson to capture New York and fought fiercely against them, though the other Indians favored them. Champlain also explored the country toward the north and helped to build up the fur trade, which later brought in so much money to the French.

Father Marquette was a Jesuit missionary who came over to convert the Indians. He heard of a great river in the west and joined Louis Joliet, who was sent to find it by the governor of Canada. They started in 1673, crossed Lake Michigan, paddled up the Fox River, carried their canoes to the Wisconsin River and floated down it to the Mississippi. Once they landed in the territory of the Illinois Indians, where they were given a great feast.

THE INDIAN CHIEF MAKES A FEAST FOR HIS GUESTS

There were four courses in this feast. First was mush made from Indian corn, which the chief fed to the two explorers from the same spoon made of buffalo horn. Next the chief took the bones out of a fish, and with his fingers fed them choice morsels. The next course was a fine fat dog, and the last was buffalo meat. After the feast they continued their journey. At last they reached the mouth of the Arkansas River. By this time they found that the Indians were becoming unfriendly, and they turned back. But they had found that this great river was the same that flowed into the Gulf of Mexico.

LA SALLE, ONE OF THE BRAVEST MEN IN HISTORY

There is one more French explorer of whom we must speak. This was Robert Cavelier, who is generally called La Salle. He seems to have been one of the bravest men that ever lived. After he determined to explore the Mississippi to its mouth, luck seemed to be against him. A ship called the Griffon, which he built in the Niagara River, was lost with valuable furs. The garrison of a fort he built mutinied and tried to kill him, but he beat them and sent them back to be punished. His best friend, Tonty, who was waiting for him in an Indian village, was almost captured by other Indians and was forced to wander in the woods. A ship bringing to him money from France was lost.

None of these misfortunes had any effect upon his spirit. When he found that he could not get a vessel to sail down the river, he said that he would go in canoes. These he and his companions carried across from the Chicago River to the Illinois River. They floated down this to the Mississippi and then started on their long journey to the Gulf of Mexico in February, 1682. The party consisted of twenty-three Frenchmen, eighteen Indian men, ten squaws and three children.

A BRAVE FRENCHMAN FLOATS DOWN THE MISSISSIPPI RIVER

They paddled on, passed the point where Marquette and Joliet turned back, and finally reached the Gulf of Mexico. At the mouth of the river, on the 9th of April, 1682, La Salle erected a stone declaring that all the country through which the river ran was the property of France, and named it Louisiana in honor of the French king. The French claimed that this exploration of the river gave them the right to all the country drained by that river, just as they said that the exploration of the St. Lawrence gave them the right to all the country from which water flowed into that stream.

But La Salle knew that they could not keep the country unless they had settlers in it. So he planned to place a strong colony at the mouth of the Mississippi

MORE EXPLORERS AND DISCOVERERS

John Cabot, though an Italian, commanded an English ship, and in 1497 reached the coast of North America, probably on the coast of Labrador, and so gave England a claim to the continent.

Verrazano, another Italian, but commanding a French ship, sailed into New York Bay in 1524, eighty-five years before Hudson. This fine statue now stands in Battery Park, New York City.

You have read how De Soto, vainly searching for gold, marched over what is now Florida, Georgia, Alabama, Mississippi, and other states, and how at last he reached the Mississippi River, in 1542. He crossed it, but found a grave under its waters, so that the Indians might not know of his death.

River and went to France to get men and supplies. The king listened to his wonderful story and was pleased. In 1684 he came back with four ships, but his pilot could not find the mouth of the river. Where the Mississippi flows into the Gulf it is very wide, and many other rivers flow into the Gulf. There are also many bays in the shore which look like the mouths of rivers. They sailed on and finally landed in Texas, four hundred miles west of the Mississippi. Here they built Fort St. Louis while La Salle hunted in vain for the great river.

His people did not know how to take care of themselves in the wilderness, and many died. Food became scarce and La Salle, with a few companions, started by land toward Canada to get help for the others. Some of his party, however, were bad men whom he had punished for their misdeeds, and they determined to put an end to him. So two of them went on before and hid in the bushes. When La Salle passed they shot him in the back. He was only forty-four years old, but he had had more adventures than a hundred ordinary men. He is remembered as one of the bravest men that helped to make America known.

How Francis Drake made the Spaniards fear to cross the ocean

Now let us see what the English did. You remember that John Cabot made two voyages for Henry VII, but that the English did not follow them up. Still the hope of finding a northwest passage to Asia did not die out entirely. After the great Queen Elizabeth came to the throne of England, that country and Spain were not friendly. One of the best ways to hurt Spain was to capture the ships bringing treasure from Mexico or South America. With light ships, but with good cannon, the Englishmen sailed about, looking for the heavy, clumsy treasure ships which were called galleons.

One of the most famous of these privateers, as the English called them, or pirates, as the Spanish called them, was Francis Drake. He was the oldest of the twelve sons of a poor English clergyman. While a little boy he loved to sit on the shore to watch the ships or to go down into the harbor and talk to the sailors of the strange lands they had seen. He went to sea when still a boy, and when he was eighteen was the owner and captain of a ship, which he managed successfully.

Francis Drake the terror of Spain

On one of his voyages he reached the Isthmus of Panama. While there, he climbed to the top of a tall tree and saw the Pacific Ocean. He knew that the Spanish ships were on that ocean and declared that English ships should sail there too. When he went back to England some wealthy friends provided five ships for him. The little fleet sailed in November, 1577, and after being fifty-four days out of sight of land reached the coast of Brazil. Then they sailed southward along the coast, but the winds and the fogs held them back and two of the ships were lost. Not until August, 1578, could they enter the Straits of Magellan. Here he lost two more ships, but finally his own ship, the Golden Hind, got through in spite of the wind and the tide.

He was very lucky in finding Spanish silver. Once he saw a Spaniard and an Indian driving eight llamas along the shore. He captured them and found that each llama had a load of a hundred pounds of silver. Drake even dared to sail into the harbors, and captured Spanish ships at anchor. He captured also several Spanish ships on the way home from China with silks and china and other costly things, and altogether did great harm to Spanish trade.

The Spaniards were so angry that he thought that they would probably have warships placed to capture him if he tried to go back by the way he came. So he decided to sail across the Pacific and go home that way. But first he sailed north as far as Oregon, stopping where San Francisco now stands. Here he had a great talk with the Indians, who thought the white men were gods. He called the country New Albion, which means New England, and set up a post with Queen Elizabeth's name on it to claim all the territory for her.

Drake also sails around the world

Then he sailed across the Pacific and for sixty-eight days saw no land. He stopped at the Philippines, which the United States took from Spain not very long ago, to trade with the natives and to get provisions, and once his ship ran aground in shallow water. Finally he got her off, sailed around Africa, and finally reached home November 3, 1580, nearly three years after he started.

OTHER ENGLISH EXPLORERS TRY TO FOUND COLONIES

Other famous English explorers of America were Martin Frobisher and John Davis, who tried to find the northwest passage to the north of America, and Sir Humphrey Gilbert, who was lost at sea in 1583 while trying to found a colony in Newfoundland. He and his half-brother, Sir Walter Raleigh, had decided that in the end there would be more profit in making permanent settlements than in searches for gold, silver and precious stones.

In another part of our book you are told much more about the life of Sir Walter Raleigh, and we shall not say much more about him here. He never came to North America himself, but he helped his brother, Sir Humphrey Gilbert, when he tried to plant the colony in Newfoundland. The year after his brother's death, Queen Elizabeth gave him permission to settle any lands not occupied by a Christian nation that he could discover in six years. He sent out an exploring expedition which reached what is now the coast of North Carolina, and brought back such a wonderful story that he made two attempts to found a colony there on Roanoke Island. He gave the name of Virginia to the whole coast in honor of Queen Elizabeth, the Virgin Queen. We shall tell you how both failed and how one colony disappeared, so that it is not known to this day what became of it. Look in the index to the whole book for the title "Lost Colony of Roanoke" and you will learn about it.

HENRY HUDSON, IN THE HALF MOON, COMES TO A GREAT RIVER

The Dutch at this time were great traders and sent many ships to India and the islands of the South Seas. Still hoping to find a shorter way to that region, a trading company in Amsterdam, called the Dutch East India Company, sent Henry Hudson, who was born in England but was then the captain of a Dutch ship, to try to find the way. In his little ship called the Half Moon he sailed across the Atlantic in 1609 and reached the coast near Chesapeake Bay. Then he sailed northward, looking closely for the opening into the Pacific, and September 3, 1609, thought that he had found it when he anchored in what is now New York Bay. He thought that the great river which now bears his name reached all the way across America, for it was salt because of the rise of the tides.

On the 12th of September he started up the river, seeing many Indians, who were quite willing to trade furs for beads and hatchets. He kept on about 150 miles up the river until he reached the place where Albany now stands. There he found that the water was growing shallow and that it was no longer salt. Then he sent a small boat further, but his men reported that the water grew shallower and shallower and was quite fresh. Disappointed at not finding the passage, he turned and sailed downstream. He treated the Indians well, and they liked him and gave him feasts. They thought he was the Great Spirit, who had come to visit them.

THE VAIN SEARCH FOR A SHORT WAY TO ASIA

You will read on page 4971 about the later voyages of this good captain and about his sad end, but his name will be always remembered by the great river and the great bay in Canada which he discovered and which bear his name to this day. In 1909, three hundred years after he first saw Manhattan Island, the citizens of New York had a great celebration in his honor.

Because men had found out that America was very narrow at Panama, and not very wide at other parts of Central America, they thought that other parts must be narrow also. They felt sure that somewhere there must be a passageway by which they could reach Asia. America had been a great disappointment. No nation except Spain seemed to be able to find gold or silver, and the New World kept them from reaching Asia. For more than a hundred years after the discovery there had been few attempts to found colonies. Men tried to find treasure or this western passage to Asia. It was not until the Panama Canal was dug in our own time that the passage to Asia was opened through the Americas.

THE VAIN SEARCH FOR GOLD IN NORTH AMERICA

You will find that even after colonies were founded many men wasted their time hunting for gold and precious stones, instead of cultivating the soil and trying to get food. Only small quantities of food could be brought from Europe in the little ships which were then built.

When that food was eaten up the foolish men often almost starved. In fact, many of the early colonists were so weakened by hunger during the long winters that they fell easy prey to disease.

They were not altogether to blame, for the first explorers, or rather some of their crews, had spread lies about the new countries beyond the sea. It was believed in Europe that the sands of the rivers were full of gold, and that the pebbles in the brooks were precious stones. So, many of the first colonists expected to gather up a fortune in a few days or weeks and then go back to Europe and enjoy it. Sometimes the crews of the ships which had brought them would not sail again until they, too, had joined in the search, and meanwhile they helped to eat up the scanty supplies.

WHAT EACH NATION HAD DONE

Now let us look back and see what the different nations of Europe had accomplished in the first century, or a little more, after the New World had been discovered. The sixteenth century was the century of exploration, and in the seventeenth settlement began in earnest in many parts of North America. In the northern half of the continent, which was beginning to be called Canada, exploration was not so rapid and went on for a long time.

The Spaniards had conquered Mexico and had explored a good deal of territory beyond the Mississippi by means of parties sent out from Mexico. They had explored much of the southern part of the country east of the Mississippi and had also made settlements in Florida. They claimed almost all of the southern part of the United States, though they had made few settlements.

The French had explored the St. Lawrence River and the Great Lakes and the Mississippi River besides. They claimed as their own all the country from which water ran into any of these. They had several settlements on the St. Lawrence and one on the Gulf of Mexico. Their attempts at settlement in what is now Nova Scotia had not been very successful.

The English claimed the whole of North America extending to the Pacific Ocean because it had been discovered by John Cabot, but did not have a single settlement until 1607, when Jamestown was founded, though they had tried and failed.

The Dutch claimed the Hudson River and the country down to the Delaware River (which they called the South River) by right of discovery, and at once sent trading-ships to get furs. Soon a little trading-post grew up on Manhattan Island, which was later to grow into the town of New Amsterdam, and then into the great city of New York.

You will find later that Sweden also tried to plant a colony in America, but that nation had little share in exploring the new country, though under two great rulers it increased very much in power and influence.

THE POPE DIVIDES THE WORLD BETWEEN SPAIN AND PORTUGAL

You have already read in the story of Columbus that Portugal was once a powerful country with many ships and brave sailors, and you have wondered, perhaps, why that country had no share in the work. The reason for this is very easy to tell, and shows also how much power the Pope and the Church had in those days.

When Columbus returned to Spain, King Ferdinand wrote of the discoveries to the Pope, and asked him to give him the right to these heathen lands. The Pope answered by drawing a line down the Atlantic Ocean about three hundred miles west of the Azores Islands, and giving to Spain all the new heathen lands west of the line, and allowing Portugal the lands to the east. This was called the "Papal Line of Demarcation."

Portugal was not satisfied, and had the line moved eight hundred miles further west, but still the line did not touch North America, though it came very close to Newfoundland, and the brothers Corte-Real explored the region, hoping that Portugal could claim it. A part of South America was east of the line, and in 1500 a sailor named Cabral touched the coast of what is now Brazil, and Portugal planted a colony there.

As you have seen, much of the land was claimed by two or even three nations, and we shall see later that fierce wars grew out of these claims. We shall soon learn how people went to work to build homes for themselves in the new land across the sea.

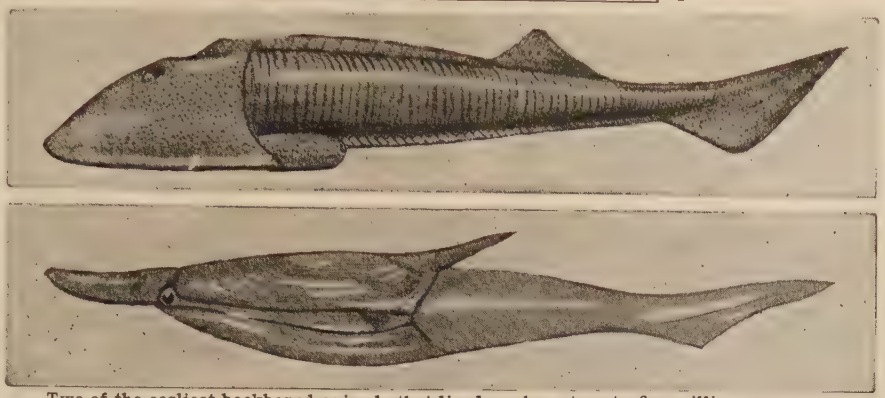
THE NEXT STORY OF THE UNITED STATES IS ON PAGE 361.

BALBOA IN CENTRAL AMERICA

Balboa and his men march into Central America, where they start the first European colony.

Cortes marches on to the conquest of Mexico.

John and Sebastian Cabot leave Bristol on their voyage of discovery.—From the painting by Ernest Board.



Two of the earliest backboned animals that lived, perhaps twenty-five million years ago.

ANIMALS WITH BACKBONES

CONTINUED FROM 52

WE read here of the way in which life became clothed—that is, of the making of the body. The first animals were never able to do much in the world for two reasons. They lived in the sea and could not get enough oxygen, and they had no backbone, and no animal without a backbone has ever been of much importance in the world.

If we could summon before us all the animals that exist, and look at them carefully, we should be able, in spite of all their differences, to divide them up into two great classes. All the animals in one class would be far more like each other than they would be like any animal in the other class. In the one class we should place all the animals that have a backbone, and in the other all the animals that have not.

It is true that we should find a few animals about which we could not be sure. We should have to place them between the two classes, for there are a few kinds of animals still living which have only half a backbone, or something that looks like a rough model of a backbone. These animals are immensely interesting.

Let us begin first with what are much the least important class of animals—those which have no backbone. We deal with them first because they actually came first. Scientists believe that for ages there were animals of many kinds living in the sea, and others living on land, which had no backbones; and if you had searched the whole earth and all the seas you would not have found a backbone anywhere—or a real brain.

These animals that have no backbones are very difficult to arrange in any kind of order. Some are more wonderfully made than others, and have not existed so long. But they differ from each other so widely that it is really impossible to arrange them in a simple order. In any case, however, these backboneless animals, such as insects, oysters and worms, are very humble and unimportant.

None of them has a real brain. This does not mean that they cannot feel, nor that some of them, such as the bees, are not wonderful in many ways; but, after all, without a brain no great progress could be made. So we need here say no more about the backboneless animals.

Nor need we here say anything about the curious kinds of animals that show us the first hints of a backbone. We may begin with those animals in which the first complete backbone is to be found. They are the fishes.

If we study all the kinds of backboned animals, we find they can all be

arranged in a simple way. More than this, it is possible to show which class is the simplest and which last.

Here, then, are the five great classes of the backboned animals—fishes, amphibia, reptiles, birds, mammals. Some of these words are strange, but they are really not difficult, and we shall easily explain them. For instance, if you have not heard of amphibia before, at any rate you know a frog when you see it, and if you have never heard of mammals, it is easy to remember that mammals are animals which feed their young by means of milk, as, for instance, a cow, which feeds her calf. A human mother feeds her baby in the same way.

THE HISTORY OF THE ANIMALS THAT HAVE BACKBONES

There are very great differences between a fish, a cow, a sparrow and a frog; yet they all agree entirely in the main lines on which their bodies are made, because they all have a backbone. And we shall soon see that they agree in many other things besides. It is true that the fish is cold-blooded and breathes water, or, rather, the air dissolved in water; while a cow or a sparrow is warm-blooded and breathes air. So far as the great history of the body is concerned, all these backboned animals are far more like one another than like any animal that has no backbone.

Now we want to trace, if we can, the history of these various kinds of backboned animals. The first, it is believed, were the fishes. The backbones of the fishes are the principal part of what we call their skeleton; and this skeleton, inside their body, is covered with soft parts like muscle and skin. This fact—the possession of a skeleton inside the body, built up around the backbone—is true of all backboned animals.

But on no account must we confuse the fishes with animals like the whale, which is a new-comer compared with the fish; and we must here give up, once and for all, the utterly wrong notion that all the animals found in the sea are fishes. Some of these animals have existed ages and ages longer in the sea than any fish. They have no backbones, no hints of a brain, and are as inferior to the fish as the fish is to a cow. We have no more right to call crabs fishes because they live in the water than we have to call a worm a bird because it breathes the air.

Backboned animals very often have limbs—fore legs and hind legs, or arms and legs, or wings and legs—and the making of these limbs is one of the most important facts in the history of the body.

THE MAKING OF THE BODY—THE FISH AND THE LAND ANIMALS

The nearest approach to anything like limbs in fishes is their fins. Scientists tell us that certain fishes had a long fin stretched right along each side of the body from head to tail. Some of them say that there is evidence that from these fins were formed, as the ages went on, two pairs of limbs, one pair in front and one behind. At any rate, they appear from this time in all backboned animals higher than the fishes.

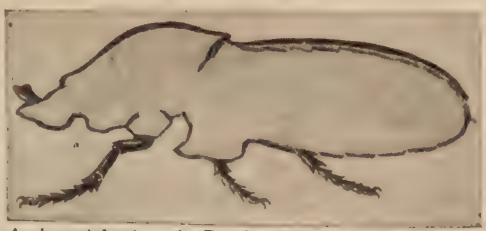
Now, we remember the great step taken by life on shore. We know even now certain fishes which can get along for some time in the air. This may give us a little hint, especially as some of these fishes are able to hop along in the mud. If now we turn to the next class of backboned animals, which have that difficult name amphibia, we shall see some interesting things.

Amphibia is really a Greek word, and means "both-life." It is a word made up to say that animals of this kind, such as the frog, lead both kinds of lives—in water and on land; each amphibian begins by leading the one kind of life and goes on by leading the other, and this gives us a hint—the history of life in the great chain of backboned animals.

THE ANCESTORS OF THE FROGS AND THEIR BACKBONES

When the frog is very young, it is called a tadpole. This lives in water and breathes water. If it never went any farther, we should properly call it a fish. So long as it is a tadpole it is a fish; but, of course, if it were no more than a fish it would live in water all its days. The tadpole does not do this, but after a time it begins to make great changes in itself; there begin to be hints of limbs and, what is even more important, of lungs; and at last the little tadpole grows into a frog, which is not a fish, which has arms and legs, or fore limbs and hind limbs, and breathes air by means of lungs. But this is not the only development; for the frog has hands, as we have, each having four fingers and a thumb, while it has five toes on each of its feet. Ages and ages ago the first frogs showed the kind

THE BACKBONE—NATURE'S STAMP OF MERIT



An invertebrate—the Beetle, which has no backbone.

A vertebrate—the Mouse, which has a backbone.

The monster Diplodocus which formerly roamed in western North America.

The skeleton of Diplodocus at South Kensington, with its backbone eighty-four feet long.

A familiar invertebrate—the common Lobster.

The backbone is nature's stamp of merit. The backboned creatures we call vertebrates; those without backbones are invertebrates. The backbone may be long as in old Diplodocus shown above, or short, as in a mouse; but it always means a highly developed nervous system. The animals without backbones, like the lobster, may have splendid outside armor, but they always belong to a much inferior type of life.

of limbs which all backboned animals since then have had; though some of them, like the bird, do not keep this kind of five-fingered limb all their lives.

Now, when the frog is grown from the tadpole into a backboned animal with four limbs, breathing air by means of lungs, it is really very much like certain of the next class of backboned animals, which are called reptiles. It is not like a snake, but it is like a little lizard—especially if the lizard has no tail. Indeed, the simplest way of looking at this is to think of the amphibia as fishes when they are young and as reptiles when they are grown up. The young frog, or tadpole, is practically a fish, because it is made as a fish is made and does what a fish does. The grown-up frog is practically a reptile, because it is made as reptiles are made and does what they do.

WHEN THE REPTILES WERE THE MASTERS OF THE EARTH

Now we leave the amphibia and may pass on to the next class of backboned animals in our classification, which were the reptiles; and of these we need not say much, except that many of the reptiles gradually lost their limbs and have become very long and round and crawling, until at last they took the shape of snakes and serpents. Snakes and serpents in their very earliest stages show many signs that they are the children of creatures that had limbs. A snake has no limbs that we can see; it has lost them and has taken to moving about in a different way.

Now we are getting much higher and are coming to times nearer to our own. There was a stage in the story of life when the reptiles were masters. There was then nothing to beat them. They grew to great sizes, and if you go to museums you may see the remains of their bodies, sometimes sixty feet long, or more. Some of them, especially the smaller ones, grew great stretches of skin between their outspread fingers, a sort of web such as we find in the feet of many swimming birds, and so they were able to fly more or less. Some of them were perhaps very fierce and powerful, and they had terrible teeth.

Then, somehow, a wonderful thing happened. This was guessed at long ago, but only last century the discovery of the remains of certain curious animals which do not now live on the earth at all gave further strong evidence.

HOW THE BIRDS FIRST CAME INTO THE WORLD

If you think of a snake, and then of a lark, you would never suppose that the birds are at all similar; but if, instead, we take a reptile, such as a small lizard, which has not lost its limbs, and then look at the remains of certain creatures which once existed, we see that they are much alike.

Of course there are a great number of very marked differences between reptiles and birds, both in their appearance and in their ways of life. No bird now living has teeth, for instance; birds have feathers, and so on. Yet we discover the remains of birds which once had teeth, and scientists think that birds have sprung from the reptiles.

Lovers of birds are almost inclined sometimes to place them on a level with the mammals themselves, and it is true that in some ways the birds are equal to the mammals, and in others even superior to them. But really no one, not even the best lover of birds, questions that the highest group of animals, and indeed of living things of any kind, is the mammals. Where did they come from?

It does not seem likely that the mammals sprang, like the birds, from the reptiles, and it is quite certain that birds did not spring from mammals or mammals from birds. The scientist goes back, not so far as the fishes, but at any rate as far as the amphibia, to find a possible origin for mammals.

THE GREAT UPWARD CLIMB OF THE ANIMAL WORLD

Those scientists who teach the theory of development believe that the amphibia developed from the fishes. From some of the amphibia reptiles and birds come, and from other amphibia, the mammals. If this be true, the first mammals must have led a hard life on the earth during the age of reptiles.

They cannot have had anything like the strength of the reptiles, yet they survived and flourished—partly by keeping out of the reptiles' way and by going to corners where the reptiles did not want to live, but more especially because of the great care they gave to their young—a care far better and finer than anything to be found in the rest of the world of life. And so they went on from strength to strength.

Now, throughout all these long ages,

while so many changes have been happening, and so many different kinds of animals have appeared upon the earth, nothing has ever happened to cause the disappearance of the backbone.

THE CHIEF FACTOR IN THE MAKING OF OUR BODIES

On the contrary, it has steadily become more and more perfect. You know what the backbone of a herring is like. It is a very useful thing, without which no herring or other fish could grow; but it is very simple and fit only for a creature which leads a very simple life and from its birth to its death makes practically only one kind of movement.

As we pass upward we find—in the frog, for instance—that the backbone is becoming at the same time stronger and less simple, and as we pass up higher still we find this process going on until, in a mammal, the backbone is so complicated that we might spend a lifetime in studying it.

In ourselves, as in the fish, it is the chief factor in the making of our bodies. It is something like the keel of a ship, upon which everything else is built; but it is, at its simplest and smallest and weakest, a million times more wonderful than the keel of the biggest ship ever made.

THE BUILDING-UP OF THE BACKBONE OF THE BODY

We know that the backbone is not really one bone, but is made up of a number of little bones laid in a line. Indeed, these bones are built or placed on one another just as we may place a number of stones on one another in building. For this reason the backbone, or spine, is often called the spinal column. The little bones of which it is made have the not really very difficult name of vertebræ, a single one being called a vertebra; and the scientific name for animals that have a backbone is Vertebrates, while those which have none are called Invertebrates.

All backboned animals above the fishes either have two pairs of limbs all their lives; or have them at the very beginning and lose them afterward, like the snakes; or have them when they are grown up, but not at first, like the frog. No backboned animal ever has more than two pairs of limbs.

The serpent loses its limbs, the whale's fore limbs are its flippers. In order to find its hind limbs, or legs, which have fallen out of use altogether, you have to dig deep in its blubber, or fat. But there you will find them all the same—toes and all. The birds no longer have fore limbs but have wings. When the chick is very young it has five fingers on each hand, like its forefathers, but later these are more than are needed to build a wing upon, and when it is grown up we find that the wing is really built upon only three and a half fingers. The other one and a half have disappeared, as they were not wanted.

The use of limbs is for movement; but if we trace limbs upward from the days of the frog, or at any rate from the days of the earliest mammals, we find that the fore limbs begin to be used not only for movement, but also for other purposes. For instance, we know for what terrible purposes the tiger and other great cats use their claws.

HOW IMPORTANT IS THE FREEDOM OF MAN'S ARMS

If we examine a higher mammal than the tiger—as, for instance, the monkey—we find that he does much more with his fore limbs. The cleverest lion or tiger, though it will steady its food with its claws while gnawing at it, cannot pick up its food and take it to its mouth. The monkey does this: it has learned the art of grasping.

In man the spinal column is a real column because he stands upright; only babies now use their fore limbs for walking. Once the crawling stage is passed, our arms are freed forever from purposes of walking, and are used, instead, as the great servants of the brain, without which man could have done nothing in the world and, indeed, would have been starved and hunted out of the world by animals long ago.

A great author once called man "the tool-using animal," and there is much truth in the saying. There are many other important differences between man and other animals—to say nothing of the soul—but think of the great difference the ability to use tools makes in our life.

It is almost impossible to say how important is the freedom of man's arms, or fore limbs, from the mere purpose for which he now uses his feet, and for which the hands of all other backboned animals have been used for so many ages. But the hands of men, as we said, are the servants of the brain and the nerves.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 437.

SOME EARLY TYPES OF TALKING MACHINES

When the graphophone was invented there were no electric or spring motors. The first machine was attached to the table of a sewing machine, and was made in a sewing-machine factory.

This is one of the earliest machines made with a spring motor, which ran at uniform speed. It was a great improvement on the treadle.

This is the MacDonald Graphophone Grand, once considered very wonderful, though now it is old-fashioned and does not compare with the marvelous machines of the present. The cylinder record and the horn are seldom seen now.

Here are some early talking machines. The great difficulty at first was motive power, and not until the spring motor, the speed of which could be controlled and kept uniform, was developed, was progress possible.

WHAT THIS STORY TELLS US

TO some of us the most wonderful of all the marvelous inventions, of which we have so many in these days, is the talking machine, no matter by what name we call it. That a flat black disk covered with tiny lines should be able to give to us the golden voice of Melba or Caruso, the wonderful tones of a violin in the hands of a master, the full crash of a brass band, or the winged words of a great orator, seems impossible to believe. Yet we know that it is true. Here is the whole story of the great invention—how the invention came to be, how records are made, and how they can reproduce for us so marvelously. It also tells how the instrument is used in business offices as well as a means of amusement.

THE TALKING MACHINE

CONTINUED FROM 200

"DADDY, what makes it talk?" In one form or another that question has been asked by every boy and girl who has heard the modern talking machine, by whatever name it is called, pour forth the golden tones of one of the great operatic artists, or listened to the music of one of the great bands or orchestras.

We all know, from our reading in The Book of Knowledge, that sound consists of a number of regular vibrations of the atmosphere striking the little membrane of the ear, called the tympanum or eardrum, causing this little membrane to make an equal number of vibrations to those set up in the atmosphere by the voice of the singer or the notes of the instruments. These vibrations are translated by our brains, but no one can tell how it is done.

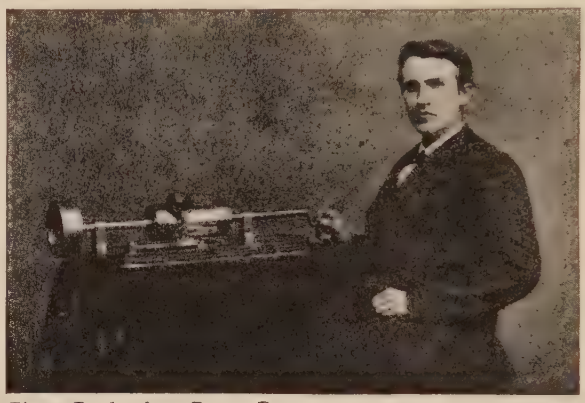
In a talking-machine record these sound vibrations are recorded in a permanent form by the use of what is called a diaphragm, which is affected by the vibrations in the atmosphere in a way similar to the effects upon the eardrum. To this diaphragm of the talking machine is attached a little needle which is called a recording stylus. As the diaphragm of the talking machine is set in motion by the vibrations this motion is imparted to the little needle, or stylus, causing it to move from side to side according to the volume or intensity of the sound communicated to the diaphragm. A soft wax-like tablet or disk is placed on the recording machine in contact with the little recording needle, and as the stylus is moved by the vibrations of the diaphragm it cuts into the soft material of the disk, which is rotating, and traces on the surface of the wax a spiral line which is called the tone groove. Looked at with the naked eye, this tone groove seems to be simply a spiral line traced over the surface of the disk, but if we examined it under a magnifying glass we could see that this spiral line has indentations corresponding to the vibratory movements of the stylus. In one type of record the indentations are on the sides of the tone groove. In the other they are on the bottom. In other words, in one type the needle moves from side to side; in the other it moves up and down.

The wax-like disk on which the tone groove is traced is called the "master record." When this master is secured it is put through an electroplating process whereby a matrix is secured. This matrix is used to procure a die or stamp from which the talking-machine records that are sold to the public are stamped or pressed. Many duplicates can be made from this stamp, and this is why they are comparatively cheap.

In reproducing or repeating these sounds the operation is reversed. In place of the stylus a reproducer is used. The tone groove on the disk sets in motion the reproducer and causes it to impart to the diaphragm the movement indicated by the irregular tone groove, and this movement against the diaphragm sets up in the atmosphere the vibrations made by the singer or the band. The machine gives back what it has received.

THOMAS A. EDISON AND HIS FIRST PHONOGRAPH

Scientists had known for a long time that it was possible to make a record, like writing on a page, of the vibrations of sound; but the first practical instrument to do this was patented by Thomas A. Edison in 1877. By simply reversing this machine it was found that you could "make it talk." Other inventors had been working for the same thing, and in a short time people grew very much excited over the new discovery, out of which have developed a great number of instruments for various purposes. One of these, the telescribe, took years to perfect.



Photo, Brady, from Brown Bros.

Thomas A. Edison and his first talking machine.

For a long time the talking machine was looked upon as nothing more than an "interesting toy." Early records for it were not satisfactory. They were covered with tinfoil, the best thing inventors could find, but it soon wore out. For a time wax was used, and Alexander Graham Bell and others developed and patented a wax-cylinder record.

Meanwhile a good motor had to be developed to make the talking machine operate. Originally storage batteries were used, but they were inconvenient and cost too much money. The spring motor, or clockwork motor, as it used to be called, then came into use, and it became possible to make a good machine at a low price. These motors have developed until to-day it is possible to rewind a good machine while it is playing.

It was discovered before long that to secure the best results in recording music a certain speed should be used, not too fast nor too slow, and Thomas Hood MacDonald, who perfected the first clockwork-motor models, took out patents covering the matter of speed.

FLAT RECORDS SUPPLANT THE CYLINDERS FIRST USED

The next development was the flat disk, the kind of talking-machine record most of us know to-day. The experiments of Emile Berliner, a German living in the United States, and the patent issued to J. W. Jones, advanced the art of making the disk record. At first only one side of this was used, but to-day, with practically all disk records, both sides are employed, doubling the musical capacity of the record.

Very many inventors have worked to improve the talking machine, and every separate item of its construction has been redesigned thousands of times. For instance, there are many forms of motors. The sound box, to which is attached the needle, or stylus, which travels spirally around the record, has used almost every conceivable material for its diaphragm, such widely different substances as paper, parchment, metal and paraffined cork being employed; but mica, or "isinglass," has so far given some of the best results. The early talking machines had a large horn, somewhat like a megaphone, which later was built into the body of the machine cabinet. Very many experiments were made, and years of time consumed, in producing a satisfactory shape of horn. The tube through which the sound is carried to the horn from the sound box also has been made in many different forms to try to secure good sound reproduction and such things as flexibility. In every factory making talking machines are laboratories where men are experimenting to improve both construction and performance.

Some other inventions and improvements

"Governors" to insure uniform speed of the rotating record engaged the attention of able inventors, and also such things as automatic brakes, which would stop the motor of themselves when a record had reached its end. Electrically driven motors appeared. The steel needle used in playing the record developed substitutes and improvements less likely to in-

A portable Victrola.

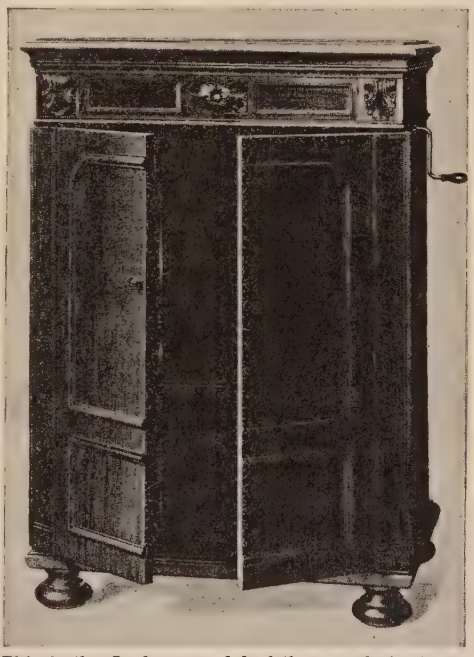
jure it by long wear. Needles made of vegetable fibre or bits of cane became very popular, and needles, or styli, pointed with the fibrous metal tungsten, have been made.

Reproducing instruments are known today by very many names, some of them trade titles. Talking machine, phonograph, gramophone, graphophone are the most common generic names, while such trade names as Victrola or Sonora have become universally known.

Talking machines of late years have grown very sensitive in the matter of capturing sounds. The ear now can distinguish all of the variety of instruments in a symphony orchestra of a hundred men, or the different instruments and voices in an operatic recording. Sounds which not every human ear is able to hear, such as the harmonics, or upper partial notes, of the violin, are recorded with ease. The voices of different persons are recognized, and their every word is clear and distinct. The early machines had a harsh metallic sound, but the causes of this were sooner or later discovered and removed. Recording-rooms had to be built so as to exclude external sounds. One annoying "scrape" was discovered to have proceeded from a tiny blower used to blow away the shavings or curls of wax made when the recording needle traced its spiral way over the face of the recording disk.

For a time the public amused itself by buying little machines made to reproduce the voice without actually recording it permanently. But people wanted something more than this. Little by little the original cylinder-shaped record, too, fell into disuse.

Besides music, the talking machine has been used to record important utterances or events. Distinguished men and women of various countries have spoken for it, and their words and voices have been



This is the Credenza model of the new Orthophonic Victrola, which is a good improvement upon previous types. It is the result of years of study and experiment and was put upon the market in 1925. Both radio and victrola may be had in one cabinet.

preserved. In the vaults of the Paris Grand Opera House and elsewhere have been placed collections of records made by great musicians, to be taken out after fifty or a hundred years and compared with records made by living artists. The voices of birds and animals have been preserved on talking-machine records, and

during the World War the sounds of battle actually were recorded and reproduced.

Very large sums of money have been paid to artists for their talking-machine records. Caruso's royalties, or commissions on the sale of his records, have reached very large sums; and $100,000 a year is not at all uncommon for a successful artist. Some of the larger manufacturers maintain their own bands and orchestras, made up of musicians of the very highest skill, for the reason that a mistake unnoticed in concert performance can always be traced and referred to on a record.

Making a record is both difficult and permanent. Even the slightest fault will be apparent in the record, and there is no way to correct it except by making another record.

Many singers find singing for records much more exhausting than singing before audiences. Scenery, lights, color, the sympathy of the hearers are all lacking in the bare room where the singer, facing a blank wall, sings into the horn. No directions can be given, even in an undertone, for they would appear on the record. All communication between singer, conductor and orchestra must be by signs.

The manufacture of talking machines

When one speaks into this machine in an ordinary tone of voice the sound-waves strike the diaphragm and a needle makes a delicate line on the wax of the cylinder as it revolves. The man can dictate his letters when convenient, even if his stenographer is busy.

interesting. Suppose the record is to be a song with a full orchestra. In the recording auditorium the singer first rehearses the song with the orchestra, perhaps several times, so that singer, conductor and players may all be in harmony. Perhaps some of the instruments, or groups of instruments, in the orchestra may be brought nearer the horn or placed farther away, until a proper balance is secured. Then a section of the song with the orchestra is sung before the horn, and registered, to discover whether the desired effect has been attained. If all is well, the recording mechanism is adjusted, the signal is given, the conductor brings down his baton, the singer and orchestra do their best, for what they are producing will be

and records has called for very large plants and large corps of employees. At the Victor plant in Camden, New Jersey, ten or twelve thousand employees are not unusual, and three or four artists or organizations may be playing or singing for records at the same time in different rooms.

This great plant grew within a very few years from a little machine shop which did general repairs, made models for inventors and manufactured, in a small way, a stitching machine for bookbinders. The owner of the shop, Eldridge R. Johnson, became interested in talking machines through having one of the early types brought to his shop for repairs. He began to experiment, with the idea of making a machine which

would successfully reproduce music. Success finally came, and machines were put on the market. In 1901 the little shop and the owners of the Berliner patents joined forces, and the little concern soon grew into a great one with much complicated machinery and a large staff of experts.

Few inventions have given so much pleasure to so many people. Not only can good music of every kind be heard in the smallest village, but music for gymnastics and dancing can be had at any time without an extra teacher to play for the drills, or without keeping one of the party at the piano, and the phonograph never tires.

The talking machine is not only a joy in the home, but is also useful in the business office as well. The dictating machine known as a Dictaphone, or Ediphone, or some such name is being used more and more, and saves much valuable time. We are showing you two pictures which will explain how it works better than we can do in words.

A wax cylinder is put on, and the machine is started. The man talks his letter into the tube, as you see, and as he talks, everything he says is cut in a tiny line on the wax surface. The cylinder will hold perhaps a dozen letters before it is full. When the man has finished he stops the machine.

When the typist is ready to write the letters she comes to this same machine, pushes a little lever, puts two tiny tubes in her ears, and the machine gives back to her exactly what has been said. She then strikes the keys of her typewriter, and soon the letter is written. She can make the machine go as fast or as slow as she wishes, and can make it repeat any part as often as is necessary. In large offices different machines are used for dictation and for reproducing.

You can see the many advantages of this machine. The stenographer may be busy or out at luncheon when the employer wishes to dictate, or the employer may think of a letter he wishes to write after everyone else has gone home. He talks letters into a dictating machine, giving full directions, and even spelling strange words, and the typist can write them at her convenience. When a cylinder has been filled, and the letters have been written, a thin film of wax is shaved off the surface, and it is ready for use again. A cylinder can be shaved perhaps a hundred times.

The cylinder on which is the record of the dictation has been brought to this girl, who slips it into her machine, puts two tubes into her ears and starts the motor. She hears the words just as they were spoken, and can vary the speed or have any portion repeated if she misses a word.

The talking machine of to-day is of United States origin, though it is also manufactured in many other countries. The makers have been anxious to improve it in every way, and many devices have been invented, until now it seems as if there is little more to be done. There is not a part of the world where these machines under some name or other do not go. However, inventors promise that people will be astonished at what the future will bring.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 371.

THE LAST SCENE OF A TRAGEDY

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THE END OF THE TRAIL, BY JAMES EARLE FRASER

A STORY OF THE REDSKINS

THERE is no more picturesque figure in modern romance than the American Indian. Fenimore Cooper, whose life-story is told in this work, became famous for his stories of adventure among the Redskins. This is one of his best-known tales, told over again as a short story. Cooper wrote this romance of the American wilderness in 1826, at a time when the Indians were still fairly numerous and often took to the warpath against the white settlers. They had their encampments even in the Great North Woods of New York. Now the race is greatly reduced, and the "noble red man," as described in romance, before long will have disappeared entirely from his native scene.

THE LAST OF THE MOHICANS

CONTINUED FROM 140

IT was summertime in the year 1757, when the British colonists in America were carrying on a war with the French, then masters of Canada. Always subject to attack by the different tribes of Indians, who were still numerous and formidable, the colonies were at this time more disturbed than ever. War between the French and the British also involved outbreaks with the Indians. Some of the Canadian tribes, taking to the warpath, came down into the British colonies. Danger lurked everywhere; even the townships were not secure from attack.

But one day, in the still beauty of July, three strange and picturesque figures made part of a striking scene in the American wilderness. The scene was so peaceful to look upon that one might never have guessed how near to the most exciting adventures all three were. On the high bank of a swift and swollen river the men were grouped in attitudes of ease. The dull thunder of a waterfall told that the river had come down from the higher land at no great distance away, with a tremendous fall that now sent its water boiling and churning between the steep banks.

Of the three, there were two whose dark, ruddy skins and paint-bedaubed features and bodies, with their picturesque costumes of skins and feathers, betokened them natives of the wild lands of the West. One was older than the other, for, indeed, they were father and son. The old Indian was Chingachgook, known as the "Great Serpent." He was the sagamore, or tribal chief, of the Mohicans, the remnant of a tribe of the Delaware Indians. He had all the dignity and alert bearing of an Indian chief, though his body had no longer the supple beauty and suggestion of boundless energy of his son Uncas, known as the "Bounding Elk."

The third person of this little group wore a green hunting-shirt and Indian moccasins. And there lay across his knees a rifle of unusual length, the trigger of which he fingered from time to time. Almost as dark of complexion as his companions, by long exposure to the sun, it would have been difficult to tell him for a white man. But such he was, and his name was Nathaniel Bumppo. To the Indians, however, he was always known as "Hawkeye." His fame as a fearless scout and hunter was known to the French enemies, by whom he was usually spoken of as "Long Rifle."

The three men were talking quietly, and though they showed no uneasiness, they were evidently on the alert. They knew that General Montcalm, the French leader, was even then making his way through the far-spreading forests, over which their position gave them a splendid view. Montcalm was marching to attack the British in Fort William Henry, on Lake George, which was only a few leagues away from the scene. Suddenly the old Indian, putting his ear to the ground and listening intently, exclaimed: "The horses of

white men are coming!" Quickly taking cover, they had not long to wait before the cavalcade came into view. At its head was a British officer, who wore the uniform of a major in the colonial service. Beside him rode two beautiful young women, Cora and Alice, one fair-haired and blue-eyed, and the other bewitchingly dark. They were accompanied by an Indian guide and a strange, gaunt creature of unkempt appearance. Hawkeye's voice rang out in challenge as he presented himself to the little group, and the officer answered him.

"I am Major Duncan Heyward. These ladies are the daughters of Colonel Munro, who is in command at Fort William Henry, whither we are bound. Unfortunately, our Indian guide has lost his way. We should be glad if you could help us to regain it."

This was enough to make clear to the hunter that the Indian had betrayed the party. "An Indian lose his way!" he said scornfully. He made a sign to his own companions, who immediately slipped into the bushes to cut off the false guide. But with a wild shriek the guide bounded away and succeeded in eluding them.

It was clear that the travelers had been betrayed. No time was to be lost if they were to escape falling into the hands of cruel Indians, for the guide was known as a chief of the Hurons, enemies of the English. Dusk was gathering, and there was no hope of reaching the fort that night. Hawkeye led the four strangers down to the river's edge, giving the horses over to his Indian companions. From a place of concealment he drew forth a frail birch-bark canoe, in which the travelers took their seats with some difficulty, as five persons made too heavy a load. Only the marvelous skill of Hawkeye and his calm steering through the surging water against the current saved them all from drowning. But it was their only hope of escape. The four persons sat in the canoe scarcely daring to breathe, while Hawkeye coolly impelled it forward with dexterous and powerful strokes of the paddle. Meanwhile the two Mohicans led the horses into the water and took them upstream a considerable way to a little cove, where they would not be readily discovered. For, by walking the animals through flowing water, they avoided making a trail for the Iroquois to follow.

It was black night when Hawkeye at last brought the canoe into a little space of quiet water that washed a rocky island, over which the great waterfall descended like a mighty screen. Even when they had stepped on to the island, the travelers were afraid to move, through terror of the darkness and the deafening thunder of waters. There they stood, while the hunter shot away rapidly in his canoe to bring back the two Indians and a store of venison from their cache, or hiding-place. He seemed to have been gone only a little while when he appeared with his companions, and contrived to make the travelers comfortable for the night.

Hawkeye scarcely hoped that their hiding-place beneath the waterfall would escape discovery. He had chosen it only the better to withstand an attack from the Redskins, which, sure enough, was made soon after dawn next day.

But the favorable position of the island on which Hawkeye had placed his party, together with his great skill in marksmanship, kept the savage Redskins at bay until another night had come.

CAPTURED BY THE HURONS, BUT RESCUED BY HAWKEYE AND THE MOHICANS

The situation was now desperate. Their powder was gone, and the next morning would see them all shot or captured. A little council of war was held. It was decided that the scout and the two Mohicans should slip into the water and make their way to the fort in the darkness, returning at once with a rescue party. All agreed that the Redskins would make captives of the others in the morning, and it was necessary that the rescue party should be strong.

Next morning the Hurons returned to the attack. Meeting with no opposition, they made their way to the hiding-place. There they found Major Heyward and the two girls with a fourth member of the party. This was David Gamut, a singing-master attached to a Connecticut regiment, and he was really not quite sane. Instead of scalping his victims, Magua—for such was the name of the false guide—decided to take them captives. David Gamut insisted on singing a funeral psalm when he was captured, so the Indians left him practically at liberty. They believed, like many savage people, that persons of disordered minds are under a special pro-

tection. The real reason of Magua's betrayal was his desire to be revenged on Colonel Munro, at whose orders he had once been flogged.

Happily, Hawkeye and his companions, replenishing their powder from a secret store, had boldly started back on the trail without going to the fort. In the nick of time they overtook the Iroquois on the march with their prisoners, putting Magua and his braves to flight and releasing the captives.

Fall of the Fort and Recapture of the Colonel's Daughters

The little party then pushed on toward Fort William Henry. When they drew near, they found that Montcalm's troops had begun the investment of the place. By good fortune, one of the mists that rise suddenly from the lake came on. Hawkeye, knowing the land so well, was able to lead the party through the French lines unseen, to the great joy of old Colonel Munro, who had made every preparation to defend the fort against the enemy.

Bravely the old Scottish warrior and his small garrison, chiefly composed of the "Royal Americans," the regiment in which Heyward was major, defended Fort William Henry against the overwhelming forces of Montcalm. The end of it all was that Munro and his garrison had at last to surrender. But they were granted the privilege of marching out with the honors of war and a safe conduct to Fort Edward. This proved a hollow promise. They were attacked on their march through the forest by some two thousand Indians, who were attached to Montcalm's army, and a general massacre took place. Magua had also seized the occasion to reappear with a small band of Hurons. In the confusion that followed he succeeded in carrying off the sisters and the half-witted singing-master.

Colonel Munro and Major Heyward, as well as Hawkeye and the two Mohicans, managed to escape from the fray. Uncas was certain that Cora and Alice had been taken captive by the Hurons. So it was decided to make for the Great North Woods, in the hope of rescuing the girls, as in that district the Hurons had an encampment. The Delaware Indians were also encamped there, and the Mohicans were of the same race. Day after day the little party of five followed the trail into the depths of the wilderness until they felt they were nearing the Indian camp.

Emerging cautiously from the wood through which the trail had led, they saw below them a colony of beavers at work in a stream. A strange figure stood there watching the busy little animals. This was none other than Gamut, the singing-master, whose attention the party cautiously attracted. They learned from him that Alice was a prisoner among the Hurons, whose camp was some two miles off. Cora had been placed in the keeping of the Delawares ten miles away. So far the captives had suffered no harm, but what fate was in store for them who could guess? Gamut, not so mad as he seemed, had been allowed the fullest liberty by the Indians, and his help proved of great value to the rescuers.

Uncas, the Young Mohican, Falls into the Hands of the Hurons

Speedily their plans were agreed upon. Heyward was to disguise himself as one of Montcalm's scouts, and boldly visit the Huron camp in the hope of rescuing Alice. Uncas and Hawkeye were to make for the camp of the Delawares and rescue Cora. The old colonel, under the guidance of Chingachgook, was to go to a place of safety along the stream.

The singing-master took Heyward, disguised as one of Montcalm's scouts, to the Huron camp. He was received by a council of the Indians, and was parleying with them when Uncas was brought in as a prisoner. Magua, arriving with his party of braves, was overjoyed to find his enemy at his mercy. While some of the Hurons would have killed the young Mohican chief at once, Magua preferred keeping him alive to torture him later.

In the commotion which the capture of Uncas had caused, Heyward and his supposed mission from Montcalm were for the time being forgotten. The stranger in the camp was not recalled to mind until an aged chief came forward to ask whether the white brother had skill in magic. To this the major, with a little hesitation, not knowing whither he might be led by his reply, answered that he had.

Saying that an evil spirit had entered into the wife of one of his young men, the Indian then led the way to a cave in the mountainside, some little distance from the camp. There a young woman lay, evidently very ill.

"Now let the white brother show his

power," said the old Indian to the major. "I go. Brother, the woman is the wife of one of my bravest young men; deal justly by her. Peace," he added, beckoning to quite a large tame bear that had followed them into the cave, rolling and grunting. "I go."

The old Indian then left the supposed worker of magic in the cave. He had no sooner gone than the animal, which Heyward took to be one of the tame bears sometimes kept in Indian villages, rose on its hind legs. The great ungainly head was lifted up to disclose the bronzed face of Hawkeye the scout!

THE SCOUT AND THE MAJOR OUTWIT THE INDIANS AND RESCUE ALICE

After his first moment of surprise Heyward said to the scout: "Tell me the meaning of this masquerade. Why have you attempted so desperate an adventure?"

"The capture of Uncas is my reason for being here, and his own hot blood was the reason of his falling into the hands of the Hurons. By a stroke of luck I discovered an Indian conjurer, the owner of this bearskin, who was preparing for the entertainment of the village. Speedily securing him, I made free with his finery, and am here to play his part, though not quite as he had intended. But let us hasten, for Alice is most likely hidden somewhere here," said Hawkeye.

In an inner cave they were happy to discover the fair object of their search. Just at that moment Magua appeared at another entrance, only to be instantly disabled by the two white men, and bound and gagged. Quickly wrapping the girl in a blanket, Heyward took her in his arms. Followed by the scout, who again imitated the walking of the bear, they appeared at the entrance of the outer cave, where were some of the relatives of the sick woman.

"Has my brother driven away the evil spirit?" demanded the old Indian. "What has he in his arms?"

"Thy child is better," returned Heyward gravely. "The disease has gone out of her; it is shut up in the rocks. I take the woman to a distance where I will strengthen her against any further attack. She shall be in the wigwam of her husband when the sun comes again."

This speech satisfied the people. So, followed by the bear, Heyward, carrying Alice, passed boldly through the crowd and into the woods. When they had gone some distance, the scout urged Heyward to make with all haste for the camp of the Delawares and demand protection, as they were friendly Indians. Hawkeye would return to try to save young Uncas.

THE HURONS DEMAND THE RETURN OF PRISONERS FROM THE DELAWARES

When the scout had reached the outskirts of the encampment again, he encountered Gamut and disclosed his plans to him. Singing his loudest, Gamut led the way to the wigwam where Uncas was imprisoned. The mad singer told those who watched that he and the bear-conjurer were going to work a spell upon the captive. Believing that within the skin of the bear was the form of their own favorite magician, and that Gamut himself had supernatural power, the Indians made way for the two to enter. No time was lost now in making Uncas exchange places with Hawkeye. The scout changed his own clothes for those of the singing-master, whom they were to leave behind, knowing that the Indians would do him no harm. The ruse was successful. Hawkeye and Uncas escaped into the forest, eluding the pursuit which the Hurons soon began when they discovered the deception that had been practiced.

Major Heyward in the meanwhile had made such good haste that he arrived safely with Alice in the camp of the Delawares, and was granted protection. When Hawkeye and Uncas came later and asked for hospitality, they were placed under guard, though not unkindly treated.

Next morning Magua and a band of his followers appeared in the Delaware camp, dressed and painted as if for peace, to claim the return of their prisoners. A great council of the Indians was called, over which the oldest chief, named Tamenund, presided.

"Justice is the law of the great Manitou," said the venerable chief Tamenund, then over a hundred years old, in delivering judgment. "My children, give the strangers food. Then, Huron, take thy prisoner and depart."

Before the prisoners are given up to Magua, Cora appeals to the old chief. At her request Tamenund orders Uncas to be brought before the council.

In Fenimore Cooper's own words the story is now carried on:

. . . . . .

UNCAS REVEALS HIMSELF TO HIS PEOPLE

THE silence continued unbroken by human sounds for many anxious minutes. Then the waving multitude opened and shut again, and Uncas stood in the living circle. He cast a deliberate and observing look on every side of him, meeting the settled expression of hostility that lowered in the visages of the chiefs, with the same calmness as the curious gaze of the attentive children. But when, last in his haughty scrutiny, the person of Tamenund came under his glance, his eye became fixed, as though all other objects were already forgotten. Then advancing with a slow and noiseless step up the area, he placed himself immediately before the footstool of the sage. Here he stood unnoted, though keenly observant himself, until one of the chiefs appraised the latter of his presence.

"With what tongue does the prisoner speak to the Manitou?" demanded the patriarch, without unclosing his eyes.

"Like his fathers," Uncas replied; "with the tongue of a Delaware."

"A Delaware! I have lived to see the tribes of the Lenape driven from their council fires and scattered, like broken herds of deer, among the hills of the Iroquois! I have seen the hatchets of a strange people sweep floods from the valleys, that the winds of heaven have spared! The beasts that run on the mountains and the birds that fly above the trees, have I seen living in the wigwams of men; but never before have I found a Delaware so base as to creep, like a poisonous serpent, into the camps of his nation."

"The singing birds have opened their bills," returned Uncas, in the softest notes of his own musical voice; "and Tamenund has heard their song."

The sage started and bent his head aside, as if to catch the fleeting sounds of some passing melody.

"Does Tamenund dream!" he exclaimed. "What voice is at his ear? Have the winters gone backward? Will summer come again to the children of the Lenape?"

A solemn and respectful silence succeeded this incoherent burst from the lips of the Delaware prophet. After a patient pause, however, one of the aged men, perceiving that the sage had lost the recollection of the subject before them, ventured to remind him again of the presence of the prisoner.

"The false Delaware trembles lest he should hear the words of Tamenund," he said. " 'Tis a hound that howls, when the Yengeese shows him a trail."

"And ye," returned Uncas, looking sternly around him, "are dogs that whine, when the Frenchman casts ye the offals of his deer!"

Twenty knives gleamed in the air and as many warriors sprang to their feet, at this biting, and perhaps merited retort; but a motion from one of the chiefs suppressed the outbreaking of their tempers, and restored the appearance of quiet.

"Delaware!" resumed the sage, "little art thou worthy of thy name. My people have not seen a bright sun in many winters; and the warrior who deserts his tribe when hid in clouds is doubly a traitor. The law of the Manitou is just. It is so; while the rivers run and the mountains stand, while the blossoms come and go on the trees, it must be so. He is thine, my children; deal justly by him."

Not a limb was moved, nor was a breath drawn louder and longer than common, until the closing syllable of this final decree had passed the lips of Tamenund. Then a cry of vengeance burst at once, as it might be, from the united lips of the nation; a frightful augury of their ruthless intentions. In the midst of these prolonged and savage yells, a chief proclaimed, in a high voice, that the captive was condemned to endure the dreadful trial of torture by fire. The circle broke its order and screams of delight mingled with the bustle and tumult of preparation. Heyward struggled madly with his captors; the anxious eyes of Hawkeye began to look around him, with an expression of peculiar earnestness; and Cora again threw herself at the feet of the patriarch, once more a suppliant for mercy.

Throughout the whole of these trying moments, Uncas had alone preserved his serenity. He looked on the preparations with a steady eye and when the tormentors came to seize him, he met them with a firm and upright attitude. One among them, if possible, more fierce and savage than his fellows, seized the hunting shirt of the young warrior and, at a

single effort, tore it from his body. Then, with a yell of frantic pleasure, he leaped toward his unresisting victim and prepared to lead him to the stake. But at that moment, when he appeared most a stranger to the feelings of humanity, the purpose of the savage was arrested as suddenly as if a supernatural agency had interposed in the behalf of Uncas. The eyeballs of the Delaware seemed to start from their sockets; his mouth opened and his whole form became frozen in an attitude of amazement. Raising his hand with a slow and regulated motion, he pointed with a finger to the bosom of the captive. His companions crowded about him in wonder and every eye was, like his own, fastened intently on the figure of a small tortoise, beautifully tattooed on the breast of the prisoner, in a bright blue tint.

For a single instant Uncas enjoyed his triumph, smiling calmly on the scene. Then motioning the crowd away with a high and haughty sweep of his arm, he advanced in front of the nation with the air of a king, and spoke in a voice louder than the murmur of admiration that ran through the multitude.

"Men of the Lenni Lenape!" he said, "my race upholds the earth! Your feeble tribe stands on my shell! What fire that a Delaware can light would burn the child of my fathers," he added, pointing proudly to the simple blazonry on his skin; "the blood that came from such a stock would smother your flames! My race is the grandfather of nations!"

"Who art thou?" demanded Tamenund, rising at the startling tones he heard, more than at any meaning conveyed by the language of the prisoner.

"Uncas, the son of Chingachgook," answered the captive modestly, turning from the nation, and bending his head in reverence to the other's character and years; "a son of the great Unamis."

"The hour of Tamenund is nigh!" exclaimed the sage; "the day is come, at last, to the night! I thank the Manitou, that one is here to fill my place at the council fire. Uncas, the child of Uncas, is found! Let the eyes of a dying eagle gaze on the rising sun."

The youth stepped lightly, but proudly, on the platform, where he became visible to the whole agitated and wondering multitude. Tamenund held him long at the length of his arm and read every turn in the fine lineaments of his countenance, with the untiring gaze of one who recalled days of happiness.

"Is Tamenund a boy?" at length the bewildered prophet exclaimed. "Have I dreamed of so many snows—that my people were scattered like floating sands—of Yengeese, more plenty than the leaves on the trees? The arrow of Tamenund would not frighten the fawn; his arm is withered like the branch of a dead oak; the snail would be swifter in the race; yet is Uncas before him as they went to battle against the pale faces! Uncas, the panther of his tribe, the eldest son of the Lenape, the wisest Sagamore of the Mohicans! Tell me, ye Delawares, has Tamenund been a sleeper for a hundred winters?"

The calm and deep silence which succeeded these words sufficiently announced the awful reverence with which his people received the communication of the patriarch. None dared to answer, though all listened in breathless expectation of what might follow. Uncas, however, looking in his face with the fondness and veneration of a favored child, presumed on his own high and acknowledged rank, to reply.

"Four warriors of his race have lived and died," he said, "since the friend of Tamenund led his people in battle. The blood of the turtle has been in many chiefs, but all have gone back into the earth from whence they came, except Chingachgook and his son."

"It is true—it is true," returned the sage; a flash of recollection destroying all his pleasing fancies and restoring him at once to a consciousness of the true history of his nation. "Our wise men have often said that two warriors of the unchanged race were in the hills of the Yengeese; why have their seats at the council fires of the Delawares been so long empty?"

At these words the young man raised his head, which he had still kept bowed a little in reverence; and lifting his voice so as to be heard by the multitude, as if to explain at once and forever the policy of his family, he said aloud:

"Once we slept where we could hear the salt lake speak in its anger. Then we were rulers and Sagamores over the land. But when a pale face was seen on every brook, we followed the deer back to the river of our nation. The Delawares were

gone. Few warriors of them all stayed to drink of the stream they loved. Then said my fathers, 'Here will we hunt. The waters of the river go into the salt lake. If we go toward the setting sun, we shall find streams that run into the great lakes of sweet water; there would a Mohican die, like fishes of the sea, in the clear springs. When the Manitou is ready and shall say "Come," we will follow the river to the sea and take our own again.' Such, Delawares, is the chief of the children of the Turtle. Our eyes are on the rising, and not toward the setting, sun. We know whence he comes, but we know not whither he goes. It is enough."

The men of the Lenape listened to his words with all the respect that superstition could lend, finding a secret charm even in the figurative language with which the young Sagamore imparted his ideas. Uncas himself watched the effect of his brief explanation with intelligent eyes and gradually dropped the air of authority he had assumed, as he perceived that his auditors were content. Then permitting his looks to wander over the silent throng that crowded around the elevated seat of Tamenund, he first perceived Hawkeye in his bonds. Stepping eagerly from his stand, he made way for himself to the side of his friend; and cutting his thongs with a quick and angry stroke of his own knife, he motioned to the crowd to divide. The Indians silently obeyed, and once more they stood ranged in their circle, as before his appearance among them. Uncas took the scout by the hand and led him to the feet of the patriarch.

"Father," he said, "look at this pale face; a just man, and the friend of the Delawares."

"Is he a son of Minquon?"

"Not so; a warrior known to the Yengeese, and feared by the Maquas."

"What name has he gained by his deeds?"

"We call him Hawkeye," Uncas replied, using the Delaware phrase; "for his sight never fails. The Mingoes know him better by the death he gives their warriors; with them he is 'The Long Rifle.'"

"La Longue Carabine!" exclaimed Tamenund, opening his eyes and regarding the scout sternly. "My son has not done well to call him friend."

"I call him so who proves himself such," returned the young chief, with great calmness, but with a steady mien. "If Uncas is welcome among the Delawares, then is Hawkeye with his friends."

"The pale face has slain my young men; his name is great for the blows he has struck the Lenape."

"If a Mingo has whispered that much in the ear of the Delaware, he has only shown that he is a singing bird," said the scout, who now believed that it was time to vindicate himself from such offensive charges and spoke as did the man he addressed, modifying his Indian figures, however, with his own peculiar notions. "That I have slain the Maquas I am not the man to deny, even at their own council fires; but that, knowingly, my hand has ever harmed a Delaware, is opposed to the reason of my gifts, which is friendly to them, and all that belongs to their nation."

A low exclamation of applause passed among the warriors, who exchanged looks with each other like men that first began to perceive their error.

"Where is the Huron?" demanded Tamenund. "Has he stopped my ears?"

Magua, whose feelings during that scene in which Uncas had triumphed may be much better imagined than described, answered to the call by stepping boldly in front of the patriarch.

"The just Tamenund," he said, "will not keep what a Huron has lent."

"Tell me, son of my brother," returned the sage, avoiding the dark countenance of Magua, and turning gladly to the more ingenuous features of Uncas, "has the stranger a conqueror's right over you?"

"He has none. The panther may get into snares set by the women; but he is strong, and knows how to leap through them."

"La Longue Carabine?"

"Laughs at the Mingoes. Go, Huron, ask your squaws the color of a bear."

"The stranger and the white maiden that came into my camp together?"

"Should journey on an open path."

"And the woman that Huron left with my warriors?"

Uncas made no reply.

"And the woman that the Mingo has brought into my camp?" repeated Tamenund, gravely.

"She is mine," cried Magua, shaking his hand in triumph at Uncas. "Mohican, you know that she is mine."

"My son is silent," said Tamenund,

endeavoring to read the expression of the face that the youth turned from him in sorrow.

"It is so," was the low answer.

A short and impressive pause succeeded, during which it was very apparent with what reluctance the multitude admitted the justice of the Mingo's claim. At length the sage, on whom alone the decision depended, said, in a firm voice:

"Huron, depart."

"As he came, just Tamenund," demanded the wily Magua; "or with hands filled with the faith of the Delawares? The wigwam of Le Renard Subtil is empty. Make him strong with his own."

The aged man mused with himself for a time; and then bending his head toward one of his venerable companions, he asked:

"Are my ears open?"

"It is true."

"Is this Mingo a chief?"

"The first in his nation."

"Girl, what wouldst thou? A great warrior takes thee to wife. Go! Thy race will not end."

"Better, a thousand times, it should," exclaimed the horror-struck Cora, "than meet with such a degradation!"

"Huron, her mind is in the tents of her fathers. An unwilling maiden makes an unhappy wigwam."

"She speaks with the tongue of her people," returned Magua, regarding his victim with a look of bitter irony. "She is of a race of traders and will bargain for a bright look. Let Tamenund speak the words."

"Take you the wampum, and our love."

"Nothing hence but what Magua brought hither."

"Then depart with thine own. The Great Manitou forbids that a Delaware should be unjust."

Magua advanced and seized his captive strongly by the arm; the Delawares fell back in silence; and Cora, as if conscious that remonstrance would be useless, prepared to submit to her fate without resistance.

"Hold, hold!" cried Duncan, springing forward; "Huron, have mercy! Her ransom shall make thee richer than any of thy people were ever yet known to be."

"Magua is a red skin; he wants not the beads of the pale faces."

"Gold, silver, powder, lead—all that a warrior needs shall be in thy wigwam; all that becomes the greatest chief."

"Le Subtil is very strong," cried Magua, violently shaking the hand which grasped the unresisting arm of Cora; "he has his revenge!"

"Mighty ruler of Providence!" exclaimed Heyward, clasping his hands together in agony, "can this be suffered? To you, just Tamenund, I appeal for mercy."

"The words of the Delaware are said," returned the sage, closing his eyes and dropping back into his seat, alike wearied with his mental and his bodily exertion. "Men speak not twice."

"That a chief should not misspend his time in unsaying what has once been spoken is wise and reasonable," said Hawkeye, motioning to Duncan to be silent; "but it is also prudent in every warrior to consider well before he strikes his tomahawk into the head of his prisoner. Huron, I love you not; nor can I say that any Mingo has ever received much favor at my hands. It is fair to conclude that, if this war does not soon end, many more of your warriors will meet me in the woods. Put it to your judgment, then, whether you would prefer taking such a prisoner as that into your encampment, or one like myself, who am a man that it would greatly rejoice your nation to see with naked hands."

"Will 'The Long Rifle' give his life for the woman?" demanded Magua, hesitatingly; for he had already made a motion toward quitting the place with his victim.

"No, no; I have not said so much as that," returned Hawkeye, drawing back with suitable discretion, when he noted the eagerness with which Magua listened to his proposal. "It would be an unequal exchange, to give a warrior, in the prime of his age and usefulness, for the best woman on the frontiers. I might consent to go into winter quarters now—at least six weeks afore the leaves will turn—on condition you will release the maiden."

Magua shook his head and made an impatient sign for the crowd to open.

"Well, then," added the scout, with the musing air of a man who had not half made up his mind: "I will throw 'Killdeer' into the bargain. Take the word of an experienced hunter, the piece has not its equal atween the provinces."

Magua still disdained to reply, continuing his efforts to disperse the crowd.

"Perhaps," added the scout, losing his dissembled coolness exactly in proportion as the other manifested an indifference to the exchange, "if I should condition to teach your young men the real virtue of the we'pon, it would smooth the little differences in our judgments."

Le Renard fiercely ordered the Delawares, who still lingered in an impenetrable belt around him, in hopes he would listen to the amicable proposal, to open his path, threatening, by the glance of his eye, another appeal to the infallible justice of their "prophet."

"What is ordered must sooner or later arrive," continued Hawkeye, turning with a sad and humbled look to Uncas. "The varlet knows his advantage and will keep it! God bless you, boy; you have found friends among your natural kin and I hope they will prove as true as some you have met who had no Indian cross. As for me, sooner or later, I must die; it is therefore fortunate there are but few to make my death howl. After all, it is likely the imps would have managed to master my scalp, so a day or two will make no great difference in the everlasting reckoning of time. God bless you," added the rugged woodsman, bending his head aside, and then instantly changing its direction again, with a wistful look toward the youth; "I loved both you and your father, Uncas, though our skins are not altogether of a color, and our gifts are somewhat different. Tell the Sagamore I never lost sight of him in my greatest trouble; and, as for you, think of me sometimes when on a lucky trail; and depend on it, boy, whether there be one heaven or two, there is a path in the other world by which honest men may come together again. You'll find the rifle in the place we hid it; take it, and keep it for my sake; and harkee, lad, as your natural gifts don't deny you the use of vengeance, use it a little freely on the Mingoes; it may unburden grief at my loss and ease your mind. Huron, I accept your offer; release the woman. I am your prisoner!"

A suppressed, but still distinct murmur of approbation ran through the crowd at this generous proposition; even the fiercest among the Delaware warriors manifesting pleasure at the manliness of the intended sacrifice. Magua doubted; then casting his eyes on Cora, with an expression in which ferocity and admiration were strangely mingled, his purpose became fixed forever.

He intimated his contempt of the offer with a backward motion of his head and said, in a steady and settled voice:

"Le Renard Subtil is a great chief; he has but one mind. Come," he added, laying his hand too familiarly on the shoulder of his captive to urge her onward; "A Huron is no tattler; we will go."

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"Ay, go," cried Duncan; "go, Magua, go. These Delawares have their laws, which forbid them to detain you; but I—I have no such obligation. Go, malignant monster—why do you delay?"

It would be difficult to describe the expression with which Magua listened to this threat to follow. There was at first a fierce and manifest display of joy, and then it was instantly subdued in a look of cunning coldness.

"The woods are open," he was content with answering, " 'The Open Hand' can come."

"Hold," cried Hawkeye, seizing Duncan by the arm, and detaining him by violence; "you know not the craft of the imp. He would lead you to an ambushment and your death—"

"Huron," interrupted Uncas, who, submissive to the stern customs of his people, had been an attentive and grave listener to all that passed; "Huron, the justice of the Delawares comes from the Manitou. Look at the sun. He is now in the upper branches of the hemlock. Your path is short and open. When he is seen above the trees, there will be men on your trail."

"I hear a crow!" exclaimed Magua, with a taunting laugh. "Go!" he added, shaking his hand at the crowd, which had slowly opened to admit his passage. Where are the petticoats of the Delawares! Let them send their arrows and their guns to the Wyandots; they shall have venison to eat and corn to hoe. Dogs, rabbits, thieves—I spit on you!"

His parting gibes were listened to in a dead, boding silence, and with these biting words in his mouth, the triumphant Magua passed unmolested into the forest, followed by his passive captive, and protected by the inviolable laws of Indian hospitality.

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So long as their enemy and his victim

continued in sight, the multitude remained motionless as beings charmed to the place by some power that was friendly to the Huron, but the instant he disappeared, it became tossed and agitated by fierce and powerful passion. Uncas maintained his elevated stand, keeping his eyes on the form of Cora, until the colors of her dress were blended with the foliage of the forest; when he descended, and moving silently through the throng, he disappeared in that lodge from which he had so recently issued. A few of the graver and more attentive warriors, who caught the gleams of anger that shot from the eyes of the young chief in passing, followed him to the place he had selected for his meditations. After which, Tamenund and Alice were removed and the women and children were ordered to disperse. During the momentous hour that succeeded, the encampment resembled a hive of troubled bees, who only awaited the appearance and example of their leader to take some distant and momentous flight.

The calm but still impatient Uncas now collected his chiefs, and divided his power. He presented Hawkeye as a warrior, often tried, and always found deserving of confidence. When he found his friend met with a favorable reception, he bestowed on him the command of twenty men, like himself active, skillful and resolute. He gave the Delawares to understand the rank of Heyward among the troops of the Yengeese and then tendered to him a trust of equal authority. But Duncan declined the charge, professing his readiness to serve as a volunteer by the side of the scout. After this disposition, the young Mohican appointed various native chiefs to fill the different situations of responsibility, and the time pressing, he gave forth the word to march. He was cheerfully, but silently, obeyed by more than two hundred men.

Their entrance into the forest was perfectly unmolested; nor did they encounter any living objects, that could either give the alarm, or furnish the intelligence they needed, until they came upon the lairs of their own scouts. Here a halt was ordered, and the chiefs were assembled to hold a whispering council.

At this meeting divers plans of operation were suggested, though none of a character to meet the wishes of their ardent leader. Had Uncas followed the promptings of his own inclinations, he would have led his followers to the charge without a moment's delay, and put the conflict to the hazard of an instant issue; but such a course would have been in opposition to all the received practices and opinions of his countrymen. He was, therefore, fain to adopt a caution that in the present temper of his mind he execrated, and to listen to advice at which his fiery spirit chafed, under the vivid recollection of Cora's danger and Magua's insolence.

After an unsatisfactory conference of many minutes, a solitary individual was seen advancing from the side of the enemy, with such apparent haste, as to induce the belief he might be a messenger charged with pacific overtures. When within a hundred yards, however, of the cover behind which the Delaware council had assembled, the stranger hesitated, appeared uncertain what course to take and finally halted. All eyes were turned now on Uncas, as if seeking directions how to proceed.

"Hawkeye," said the young chief, in a low voice, "he must never speak to the Hurons again."

"His time has come," said the laconic scout, thrusting the long barrel of his rifle through the leaves and taking his deliberate and fatal aim. But instead of pulling the trigger he lowered the muzzle again and indulged himself in a fit of his peculiar mirth. "I took the imp for a Mingo, as I'm a miserable sinner!" he said; "but when my eye ranged along his ribs for a place to get the bullet in—would you think it, Uncas—I saw the musicianer's blower; and so, after all, it is the man they call Gamut, whose death can profit no one, and whose life, if his tongue can do anything but sing, may be made serviceable to our own ends. If sounds have not lost their virtue, I'll soon have a discourse with the honest fellow and that in a voice he'll find more agreeable than the speech of 'Killdeer.'"

So saying, Hawkeye laid aside his rifle; and crawling through the bushes until within hearing of David, he attempted to repeat the musical effort, which had conducted himself, with so much safety and éclat, through the Huron encampment. The exquisite organs of Gamut could not readily be deceived (and to say the truth, it would have been difficult for any other man than Hawkeye to produce a similar

noise), and consequently, having once before heard the sounds, he now knew whence they proceeded. The poor fellow appeared relieved from a state of great embarrassment; for pursuing the direction of the voice—a task that to him was not much less arduous than it would have been to have gone up in the face of a battery—he soon discovered the hidden songster.

"I wonder what the Hurons will think of that!" said the scout, laughing, as he took his companion by the arm, and urged him toward the rear. "If the knaves lie within ear-shot, they will say there are two non-composers instead of one! But here we are safe," he added, pointing to Uncas and his associates. "Now give us the history of the Mingo inventions in natural English and without any ups and downs of voice."

David gazed about him at the fierce and wild-looking chiefs in mute wonder; but assured by the presence of faces that he knew, he soon rallied his faculties so far as to make an intelligent reply.

"The heathens are abroad in goodly numbers," said David; "and, I fear, with evil intent. There has been much howling and ungodly revelry, together with such sounds as it is profanity to utter, in their habitations within the past hour; so much so, in truth, that I have fled to the Delawares in search of peace."

"Your ears might not have profited much by the exchange had you been quicker of foot," returned the scout, a little dryly. "But let that be as it may; where are the Hurons?"

"They lie hid in the forest, between this spot and their village, in such force, that prudence would teach you instantly to return."

Uncas cast a glance along the range of trees which concealed his own band and mentioned the name of:

"Magua?"

"Is among them. He brought in the maiden that has sojourned with the Delawares, and leaving her in the cave, has put himself, like a raging wolf, at the head of his savages. I know not what has troubled his spirit so greatly!"

"He has left her, you say, in the cave!" interrupted Heyward; "'tis well that we know its situation! May not something be done for her instant relief?"

Uncas looked earnestly at the scout, before he asked:

"What says Hawkeye?"

"Give me my twenty rifles, and I will turn to the right, along the stream; and passing by the huts of the beaver, will join the Sagamore and the colonel. You shall then hear the whoop from that quarter; with this wind one may easily send it a mile. Then, Uncas, do you drive in their front; when they come within range of our pieces, we will give them a blow that, I pledge the good name of an old frontiersman, shall make their line bend like an ashen bow. After which we will carry their village and take the woman from the cave; when the affair may be finished with the tribe, according to a white man's battle, by a blow and a victory; or, in the Indian fashion, with dodge and cover. There may be no great learning, major, in this plan, but with courage and patience it can all be done."

"I like it much," cried Duncan, who saw that the release of Cora was the primary object in the mind of the scout; "I like it much. Let it be instantly attempted."

After a short conference, the plan was matured and rendered more intelligible to the several parties; the different signals were appointed and the chiefs separated, each to his allotted station.

During the time Uncas was making this disposition of his forces, the woods were as still, and with the exception of those who had met in council, apparently as much untenanted, as when they came fresh from the hands of their Almighty Creator. But Hawkeye, whose duty led him foremost in the adventure, knew the character of those with whom he was about to contend too well to trust the treacherous quiet.

When he saw his little band collected, the scout threw "Killdeer" into the hollow of his arm and making a silent signal that he would be followed, he led them many rods toward the rear, into the bed of a little brook which they had crossed in advancing. Here he halted and after waiting for the whole of his grave and attentive warriors to close about him, he spoke in Delaware, demanding:

"Do any of my young men know whither this run will lead us?"

A Delaware stretched forth a hand, with the two fingers separated, and indicating the manner in which they were joined at the root, he answered:

"Before the sun could go his own

length, the little water will be in the big." Then he added, pointing in the direction of the place he mentioned, "the two make enough for the beavers."

"I thought as much," returned the scout, glancing his eye upward at the opening in the tree-tops, "from the course it takes, and the bearings of the mountains. Men, we will keep within the covers of its banks till we scent the Hurons."

His companions gave the usual brief exclamation of assent, but perceiving that their leader was about to lead the way in person, one or two made signs that all was not as it should be. Hawkeye, who comprehended their meaning glances, turned and perceived that his party had been followed thus far by the singing master.

"Do you know, friend," asked the scout, gravely, and perhaps with a little of the pride of conscious deserving in his manner, "that this is a band of rangers chosen for the most desperate service, and put under the command of one who, though another might say it with a better face, will not be apt to leave them idle. It may not be five, it cannot be thirty minutes before we tread on the body of a Huron, living or dead."

"Though not admonished of your intentions in words," returned David, whose face was a little flushed and whose ordinarily quiet and unmeaning eyes glimmered with an expression of unusual fire, "your men have reminded me of the children of Jacob going out to battle against the Shechemites, for wickedly aspiring to wedlock with a woman of a race that was favored of the Lord. Now, I have journeyed far, and sojourned much in good and evil with the maiden ye seek; and though not a man of war, with my loins girded and my sword sharpened, yet would I gladly strike a blow in her behalf."

The scout hesitated, as if weighing the chances of such a strange enlistment in his mind before he answered:

"You know not the use of any we'pon. You carry no rifle; and believe me, what the Mingoes take, they will freely give again."

"Though not a vaunting and bloodily disposed Goliath," returned David, drawing a sling from beneath his parti-colored and uncouth attire, "I have not forgotten the example of the Jewish boy. With this ancient instrument of war have I practiced much in my youth, and peradventure the skill has not entirely departed from me."

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THE UNHAPPY FATE OF CORA, AND THE END OF A BRAVE YOUNG CHIEF

We have given a long extract from the book. Now we shall continue with our summary of the story.

Desperate fighting took place at the Huron camp. Magua and his braves, who still held out, were forced to find refuge in the rocky heights that overhung their camping-place. There they were pursued by the Delawares, and no mercy was shown. Uncas had marked down Magua for his own vengeance. But the crafty Huron had carried Cora with him, and Uncas could reach his enemy only by jumping from one perilous ledge of rock to another.

Because Cora refused to advance farther, one of Magua's followers plunged his knife into her breast. Uncas, leaping from the cliff, stumbled and fell at the feet of Magua, who buried his tomahawk in the back of the brave young chief. With a shout of exultation the Huron now sought to escape by leaping across a chasm. He all but succeeded, grasping the roots and grasses on the farther edge, and with his giant strength pulling himself up until it seemed as if he had won. But at that moment the rifle of the scout rang out, and the body of Mague fell whirling into the depths.

Uncas and Cora were laid to rest with all the wild ritual of the tribe. The old colonel, bowed with grief at the tragic fate of his daughter, was guided back to civilization by the scout, accompanied by Heyward and Alice.

Hawkeye, white man though he was, had lived too long in the wilderness to care for the ways of townsfolk, so he returned to be with Chingachgook and the Delawares.

The joy of the old chief Tamenund had been short-lived. His last words were: "My children, the pale-faces are masters of the earth, and the time of the red men has not yet come again. My day has been too long. In the morning I saw the sons of Unamis happy and strong; and yet, before the night has come, have I lived to see the last warrior of the wise race of the Mohicans."

THE NEXT STORY OF FAMOUS BOOKS IS ON PAGE 665.

Galileo on trial before the Inquisition.

THE MEN WHO MAPPED THE SKIES

CONTINUED FROM 206

IT is said that about 1609, two Dutch spectacle-makers were constructing crude telescopes as toys, and that when the astronomer Galileo heard of it, he had the happy thought of using such an instrument for studying the skies.

His name was Galileo Galilei. He was born at Pisa, Italy, in February, 1564, and died near Florence in 1642. His family had in the past been distinguished, and his mother and father, though poor, were anxious that he should be educated to be a doctor. They did not want him to study mathematics, lest the knowledge should lead him away from the profession they had chosen.

He was a very clever boy, showing skill in mechanics, in modeling and in music; and he painted so well that, had he been born earlier, he would probably have become an artist. He wished to be one, and on entering Pisa University he saw that to be a good artist he must learn geometry. This study opened new fields of knowledge to him. He read of the experiments of Archimedes, and how that great man had found out the quantity of base metal in a king's crown. Galileo saw that there was a simpler way than that of Archimedes, and he invented a balance which would solve the problem more quickly. He wrote an essay on it which so pleased a great man that Galileo was appointed to lecture on mathematics at Pisa. There was no further talk of his being either a doctor or an artist. He was allowed to follow science all the rest of his life.

But before all this he had done something for the doctors which nobody else had done. He noticed a lamp swinging in the cathedral at Pisa, and saw that, no matter how long or how short its swings, its beats were regular. This set him thinking, and he invented the first pendulum and used it to measure the human pulse, so that by its aid a doctor could tell how fast the heart of a patient beat, and with what strength or weakness. That was the first mechanical contrivance ever made to help doctors in their treatment of the human body.

While studying at Pisa Galileo felt convinced that much of the teaching of the day was wrong. People still believed in Ptolemy's system of astronomy, but for other mechanical laws they accepted what had been written by Aristotle, a scholar who, living nearly four hundred years before Christ, had been the tutor of Alexander the Great, and one of the world's great thinkers.

Aristotle was a wonderful man, and stands among the world's immortals; but not all that he said was right. One of his beliefs was that, if two bodies of the same substance fall from the same height, the heavier body will reach the earth first; that a body twice as heavy as another body must reach the earth in half the time of the lighter body. For nineteen hundred years nobody had thought of questioning this. Galileo was the first to do so. He saw that it was wrong, and he said so.

He took two shots, one weighing ten pounds and the other weighing one pound. He let them fall from the top of the leaning tower of Pisa, a monument well suited for his purpose. Now, according to Aristotle, the shot weighing ten pounds should have reached the ground in one-tenth of the time occupied by the shot weighing one pound. But they both reached the ground together.

Galileo rejoiced at this proof, but the students of Aristotle were furious. They would not believe what their eyes showed them. They could show by the books of Aristotle, they said, that such a thing could not be. But Galileo declared that, except for a light article being a little more resisted by the air than a heavy article—on account of its relatively greater surface—all bodies fall at the same rate. This made the scholars at the university angry, and they became his enemies.

How Galileo was driven from Pisa for telling the truth

Soon there was another grievance against Galileo. A man of influence wished to dredge the mud out of Leghorn harbor. The model of his machine was shown to Galileo, who said it would be impossible to do the work with it. What he said was proved to be true when the work was actually tried; but in the meantime his honesty made his enemies so angry that Galileo had to flee from Pisa and take refuge in Florence.

Now his lot was miserable. His father died, and Galileo thus had his mother, a brother and two sisters depending on him. After two unhappy years he was made professor of mathematics at Padua. He was now twenty-seven. He remained at Padua for eighteen busy years, and did an enormous amount of work for science. People flocked from all parts of Europe to hear his lectures.

Because he was poorly paid he undertook to tutor pupils, many of whom became famous men, in order that he might have money enough for the wants of himself and his family. At the beginning of his career he had believed in Ptolemy's system and had taught it to his pupils; but as he learned more, he saw that Copernicus was right; and though he knew that to teach Copernicanism meant danger to himself, he did teach it.

How Galileo with his telescope found that Aristotle was wrong

In 1609 he improved the telescope and began to use it. His lenses made an object look three times as large as when seen without them.

The first thing Galileo examined with his telescope was the moon. He saw that it was like our earth, full of mountains and hollows; but the followers of Aristotle would not believe this. The moon was perfectly round and smooth, they said. But greater wonders were to come.

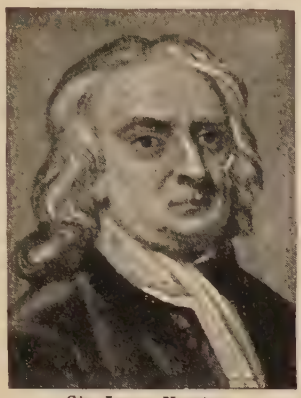
Galileo discovered, by the aid of his glass, that the system of planets was not quite what had been thought. He found that there were lesser planets revolving round Jupiter, just as other planets revolve round the sun. This excited the enemies of Galileo more than ever. How could such things be? they cried. One of them said: "There are only seven openings in the head—two eyes, two ears, two nostrils and one mouth; there are only seven metals, and seven days in the week; therefore there can be only seven planets."

Galileo made them look through the telescope, and there were the heavenly bodies to be seen. "Oh, well," they said, "they are not visible to the naked eye, so they cannot exercise any influence on the earth." His discoveries brought Galileo new fame, and he was persuaded to go to Florence at a much larger salary. He discovered many other things in the sky, and showed that although the earth goes round the sun, the sun itself is turning round as well.

Why Galileo was brought before the Inquisition

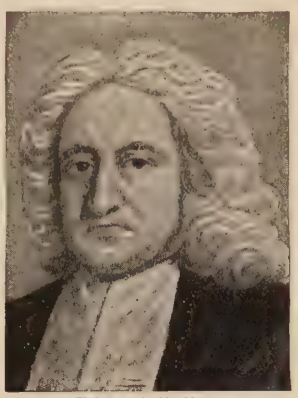
But, in spite of his fame, his enemies were too strong for him, and in 1611 Galileo was summoned before the Inquisition and warned not to teach that the earth goes round the sun. If he did not agree to this, he would have to take the consequences of his conduct. He was not punished, however, at this time.

ASTRONOMERS PAST AND PRESENT



Sir Isaac Newton.

Galileo.



Edmund Halley.

Sir John Herschel.

Nevil Maskelyne.

James Bradley.

John Flamsteed.

G. E. Hale.

Sir G. B. Airy.

Caroline Herschel.

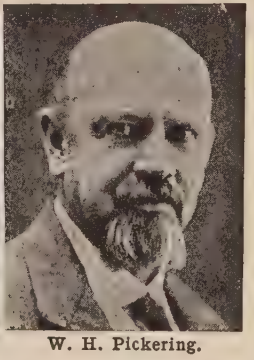
Sir W. Herschel.

Simon Newcomb.

E. C. Pickering.

Sir W. Huggins.

Sir Norman Lockyer.



W. H. Pickering.

Photos, Messrs. Maull & Fox, J. Russell & Sons, Window & Grove and Paul Thompson.

For sixteen years after this Galileo continued his studies, and then he wrote a book, published in 1632, for which he was again summoned before the Inquisition. What Galileo taught in the book appeared to the members of the Inquisition to be in direct contradiction to the Bible, which spoke of the sun's rising and setting and standing still. We know now that the sun does not really rise and set, but that the earth goes round it.

How blindness shut out from Galileo the glory of the heavens

The men who tried Galileo did not know this, and in their belief the Bible was to be taken in its literal sense in all departments of human knowledge. They could not bring themselves to agree with Galileo when the old man urged, with some humor and much cleverness, that the Bible was intended to teach men how to go to heaven, and not how the heavens go.

As a result of this trial Galileo was condemned as "vehemently suspected of heresy," and was ordered to be imprisoned. He was imprisoned twenty-two days, but was not tortured, as has been said by some historians. As a matter of fact, popes and cardinals quietly protected him and showed him how to elude the fanatics who sought to destroy him.

After this he worked at his discoveries, and wrote books of the highest importance, till he became blind. The man who, more than any other, was to teach us what the heavens show us, was himself unable, in his closing years, to see their glories. He died when seventy-eight, having given the world a great heritage of knowledge.

We see how man after man built on the foundations of those who had gone before. On foundations laid by Copernicus and Kepler and Galileo, Jeremiah Horrocks and Sir Isaac Newton built.

What Jeremiah Horrocks saw in his cheap little telescope

Jeremiah Horrocks, born near Liverpool in 1619, was one of the greatest geniuses the world has known. A poor curate, with a salary of only $200 a year, he found time in the midst of harassing work to study Galileo and Kepler, and to make himself a great master of astronomy. When he died, at the age of twenty-two, he was already world-famous. In the course of his studies he calculated that there would be a transit of Venus across the sun on the afternoon of November 24, 1639—a Sunday. As a curate he had to conduct the church services on that day, and just after concluding a service he rushed to his darkened room. There, by means of a telescope which he had bought for about sixty cents, he saw on a screen the disk of Venus already on the sun. So he beheld what man had never seen before. We can imagine his feelings as he conducted the service that day. Surely he may be forgiven if he happened to be thinking more of the works than of the words of God.

Almost all his writings were lost or burned, but enough remain to show that he was a "very strange, unaccountable genius," and Sir John Herschel calls him the "pride and boast of British astronomy." If he had lived, he might have become the greatest astronomer in the history of the world.

Sir Isaac Newton, who was born at Woolsthorpe, Lincolnshire, in 1642, the year of Galileo's death, was an equally amazing genius, and achieved even more astounding work.

Sir Isaac Newton sees an apple fall from a tree

He was not so much an astronomer as a mathematician and a thinker; but his discovery and application of the law of gravitation completely revolutionized the course of astronomy and men's ideas of the universe. His famous Principia, a work in which he published his great discovery, is one of the most prodigious achievements of the human intellect. From a falling apple his active mind deduced the laws that make the moon go round the earth, and the planets round their several suns, and the great principles which regulate mass and motion.

He was not only a theoretical astronomer, but also a practical optician; and a reflector he designed for a telescope is still known as the Newtonian reflector. His work with the prism, too, proving that white light is a blend of all colors, led the way to what is known as spectrum-analysis—the splitting-up of the white light of the sun into all the colors that make it up—and to the valuable discovery that the constituents of the stars can be detected by analyzing their light.

So he must be considered not only the greatest mathematician, but also one of the greatest astronomical geniuses that ever lived.

The extraordinary action of coincidence, by which strange and, it may be, important things came together with most happy results, was strikingly shown in connection with Sir Isaac Newton's development of his theory of gravitation.

When he first tried to apply his law of gravitation to the motion of the moon round the earth, he could not make the facts agree with his theory. The explanation was that what he had taken as facts were not facts. He had accepted sixty miles as the measurement of a degree of the earth's latitude, whereas the distance was sixty-nine and a half miles. So Newton put aside his problem and left it seven years without further study. As a matter of fact, he had been careless in accepting certain measurements of the distance round the earth.

How Sir Isaac Newton's idea was found to be right

But at the end of seven years, after Sir Isaac had been elected a member of the Royal Society, a remarkable thing happened. At a meeting of the Society there was read a letter giving the results reached by Monsieur Picard, a French mathematician. These included an exact measurement of a degree of latitude which completed the actual proof Newton was seeking. During the years that followed, Newton continued to work upon the law of gravity and its effect on the heavenly bodies, and to write about his discoveries and conclusions. In 1687 a work which thoroughly covers the subject had been finished.

While Newton was doing his great work in England, a contemporary, Christian Huygens, was doing good work in Holland. He was not only an eminent mathematician and astronomer, but an expert lens-maker; and in 1655 he discovered, by means of a twelve-foot telescope made by himself, a satellite of Saturn. In 1656 he made the first entirely self-regulating clock, which proved of extraordinary value in astronomical work and in the fixing of longitudes. He was the first man to explain the nature of Saturn's ring and to show that what we see in a star is not the star itself—which is too far off to see—but merely the light thrown by it into space.

By this time men were beginning to realize the importance of astronomy, and it was proposed that astronomers should find the longitude at sea, and so enable sailors to steer in safety and with knowledge of the course they were following.

John Flamsteed, who was born near Derby in 1646 and died in 1719, had gained a reputation by his researches in astronomy, and he was consulted about this proposal. He said so little was known of astronomy that the proposal could not be carried out, and in 1675 he was appointed the first Astronomer Royal, and Greenwich Observatory was built solely that he might make observations of the stars, to enable sailors to find their way across the seas. He did his work nobly, making reliable maps of the stars.

Pulling down a gate at the Tower to build Greenwich Observatory

The observatory was begun in a very small way. A gate-house at the Tower was pulled down to provide wood; iron and lead and bricks were taken from Tilbury Fort; and $2,600 obtained from the sale of spoiled gunpowder provided the money for wages.

Flamsteed had only $500 a year, and had to buy his own instruments. This makes his success all the more admirable, especially when we consider that his health was so bad that he could hardly do his work. He quarreled with his best friends, including Newton and Halley.

Edmund Halley was a native of London, where he was born in 1656. Before he was nineteen he had made such progress in astronomy as to be able to say that if a star were displaced in the heavens he would at once detect it.

When he knew that Flamsteed was making a map of the stars to be seen from our skies, Halley wished to make a catalogue of the stars seen in the southern skies, on the other side of the world. His father, who was rich, and proud of his boy, gave him money; and young Halley rushed away from Cambridge without waiting to take his degree, and spent eighteen months at St. Helena, making a map of 314 important stars which we on this side of the world never see. Afterward he became Astronomer Royal in succession to Flamsteed, and did fine work.

The Halley comet that we see in the Bayeux tapestry

When a great comet appeared in 1682, it was observed by both Halley and Flamsteed; and Halley, having determined its orbit, identified it as the comet which had been seen in 1607 and also in 1531; and so it was named after him.

Halley also predicted that it would again appear, after an interval of seventy-six years, in 1757. The comet actually appeared nearly two years later than Halley had said it would, owing to its path's being disturbed by the planets. It has since been discovered that records exist of the appearance of the comet on many occasions since 240 B.C., and its appearance in 1066 is pictured in the Bayeux Tapestry, of William the Conqueror's time.

THE MAN WHO MADE ISAAC NEWTON PUBLISH HIS GREAT DISCOVERY

The most important thing Halley did, however, was to make Newton publish his great book. But for him, Newton might never have published it, and the world might have waited a century for the knowledge which his book, and that book alone, could give. Halley was made a captain in the navy in order that he might continue his studies of the stars and the tides. He died in 1742.

James Bradley was Halley's successor. A native of Sherborne, Gloucestershire, he was born in 1693, and died near his birthplace in 1762. His most important work was the discovery of what is called the aberration of light. We know that light travels to us from the stars at the rate of 186,000 miles a second. What we see is not the star, but the light of the star. That light takes a definite time to travel to us, and while it is on its way here the earth is spinning on its path through space, and we see the light of the stars, not in the place where the star actually is, but where the star was some time before. The light of some stars reaches the earth hundreds or thousands of years after it leaves the star itself; and in some cases the star may be actually extinct before its light is seen on earth. This was the first clear proof of the earth's actual motion. This discovery made Bradley famous.

THE FIRST WATCH TO HELP THE SAILOR TO FIND HIS WAY AT SEA

The next great Astronomer Royal was Nevil Maskelyne, who was born in London in 1732 and died at Greenwich in 1811. He did more than any of the others to find the longitude at sea. In his time the first watch which would keep time at sea was made. That was a great thing. With the help of this watch, which carried Greenwich time out to any part of the waters, mariners had now only to observe the position of the heavenly bodies, and by comparing the local time with the time of the Greenwich watch they knew exactly where they were at sea.

A later Astronomer Royal was Sir George Biddell Airy. He was born at Alnwick, in Northumberland, in 1801 and died at Greenwich in 1892. He did an enormous amount of work in mapping the heavens and applying his knowledge to geography on land and sea. It was he who brought this work to the perfection which it finally attained at Greenwich, so that it has been said by a great man, Professor Newcomb, that if all the knowledge of this branch of astronomy were utterly lost elsewhere, it could be entirely replaced at Greenwich.

We must not overlook the Herschels, the most brilliant family in English astronomy. The first was Sir William Herschel, who was born a poor boy in Hanover in 1738 and was trained as a musician to play in a band. After 1757, when he went to England, he studied mathematics and astronomy. He was too poor to buy a telescope, so he made one for himself. With this he made some famous discoveries, of which the greatest was the planet Uranus. He was greatly assisted by his sister, Caroline Herschel, one of the cleverest and most lovable women that ever lived.

HOW CAROLINE HERSCHEL HELPED HER BROTHER TO BECOME FAMOUS

Caroline's mother did not love her, but made her a drudge in her poor house, and would not have her educated. Her father, who *did* love her, gave her music lessons in secret. A little music and a little knitting were her only kinds of work, apart from scrubbing and cleaning, up to the time of her father's death. Then she toiled to learn dressmaking and other sorts of work, sitting up late at night, after she had done the housework. At last her brother William, who was very fond of her, had her join him in England. They lived at Bath, where he gave her singing lessons and taught her English and arithmetic; and she was much happier.

Caroline, on her part, learned to imitate the violin by humming with a gag between her teeth, so that she might perform at concerts and help the funds of the home. While her brother was making the telescope, Caroline became his cook and helped him in the workshop. She helped him to polish the glasses, she cooked his food, she actually fed him with it while

SIR ISAAC NEWTON AND GALILEO

Galileo watches the swinging lamp in Pisa Cathedral.

Sir Isaac Newton sees an apple fall.

Galileo looks through the first astronomical telescope.

Sir Isaac Newton studies sunlight in a dark room.

he was at work; she read books to him while he toiled. She sang at concerts with success, but finally gave up music to help her brother in astronomy. She used to sit up all night with him to watch the stars. She copied his papers, helped him with his star-maps, kept the house, did the needlework and entertained company. She used to fill up her spare time with polishing mirrors for his telescopes.

THE BOOK THAT MADE CAROLINE HERSCHEL WEEP FOR JOY BEFORE SHE DIED

Rarely has there been another such woman as Caroline Herschel. She had her reward in time, for she herself became a successful astronomer, and made her own interesting discoveries. All her life was like a beautiful fairy story, right to the end, when, after her brother had died, she gave all her savings to his son and family, and went back to live, not very happily, with her other relatives in Hanover. It must have been a tragic and unhappy experience for her to go back, after sharing her brother's work and fame; and we are glad to feel that she was loved as few women have been, and that when she died, at the age of ninety-seven, in the troubled year of 1848, she was honored by all the great men of Europe.

The nephew to whom Caroline gave part of her money was Sir John Frederick William Herschel, her favorite brother's son, and a greater astronomer than his father. He carried on the work his father and his aunt had begun. He made a catalogue of all the stars seen in our skies; then he went to the southern half of the world and made a catalogue of the stars seen there. It was the greatest joy of his life that he was able to send a copy of the great book to his aunt before she died.

This was his most splendid work, and the dear old lady wept with pride and pleasure at seeing what her nephew had done. She was the more happy from the fact that in this noble book was the result of the work she had begun as cook and observatory "boy" to her brother.

THE WONDERS OF THE HEAVENS REVEALED IN THE SPECTROSCOPE

In the nineteenth century the wonderful little instrument called the spectroscope, about which you may read on page 3922, came to be used for astronomical purposes; and Sir William Huggins, who was born in London in the year 1824, was one of the first to develop this new and important branch of astronomy. In the beginning he felt as if he were "about to look into a secret place of creation." With the spectroscope he was able to find out the chemical constitution of stars and nebulæ millions of miles away, and even to determine the direction in which stars were going. He died in 1910.

His interesting researches were continued and extended by Sir Norman Lockyer, who concentrated his attention chiefly on the sun, and not only investigated the nature of the elements burning and shining in that great star, but, as a result of his investigations, brought forward a new and dramatic theory of the origin of the sun and its planets. His theory, known as the meteoric hypothesis, supposes that the nebulæ in which our solar system began consisted of swarms of hot stones and rocks whirling about in an atmosphere of hydrogen gas and continually colliding.

THE STIRRING MYSTERY OF THE LONG STRAIGHT LINES ON MARS

Giovanni Virginio Schiaparelli, the famous Italian astronomer, who was born in 1835, just a year before Lockyer, took a special interest in meteors and comets and in 1873 he published his famous book on Falling Stars, in which he propounded the theory, now commonly accepted that meteors are fragments of broken-up comets. He is, however, perhaps better known by his work on Mars, for he was the first observer to notice the so-called canals, or channels, on that planet. He discovered, too, that some of the channels run side by side for hundreds of miles.

The nature of these channels became the subject of much discussion, especially after the American astronomer Percival Lowell made a most earnest and thorough study of the planet, and wrote several books giving his interesting theories about it. He held that the lines, known as channels, on the surface of Mars, are broad fertile bands which lie along the sides of vast irrigation canals, dug to convey water from the melting caps of snow at the poles of the planet to distant areas. This would account for their changing in width at different periods. It would indicate, too, that there are intelligent beings inhabiting Mars, to dig the canals. Indeed, we have now become quite familiar with the thought of a race of Martians. But some astronomers feel that Professor Lowell's theory cannot be convincingly proved, and they think that some of the narrower lines in the network he has mapped may

be simply the result of a habit of eyes searching for finer and finer lines.

Professor Lowell, whose father was a cousin of James Russell Lowell, the poet, was always drawn by the mystery of the heavens, and began early to lecture and write upon astronomy. After several years in the Far East, he wrote some delightful books about Japan and Korea; but he soon put aside these other interests to devote himself to the study of the planets, particularly Mars. At Flagstaff, Arizona, where the air is unusually clear, he had built in 1894 a fine observatory, with a telescope which has peculiar power for penetrating space. There he made most of his famous observations. Born in Boston in 1855, he lived until 1916.

YOUNG AMERICANS WHO WERE DRAWN BY THE MYSTERY OF THE SKIES

In 1895 the first native American after Benjamin Franklin to be so distinguished was elected an Associate of the Institute of France. He was Simon Newcomb, an astronomer who had already, as you may suppose, given much valuable service and had won high honors in his chosen field. Born, sixty years earlier, in Nova Scotia, Newcomb, as a boy, had had no prospect of fame or fortune; but he had felt within him an assurance that somewhere there was a world concerned with books and thought, a world which did not just move around in a circle of crops and lumber and oxen and hard physical labor.

He was still very young when he sturdily started off on foot to find that world, walking fifty miles the first day. Four years after that he was employed in Cambridge, Massachusetts, as a computer on The American Nautical Almanac. His ability in mathematics and his accuracy in making astronomical calculations did not remain hidden. In 1861 he was made professor of mathematics in the United States Navy and Astronomer at the Naval Observatory, Washington. While German guns were hammering outside Paris during the Franco-Prussian War he, inside the city, was calmly observing the motion of the moon. In 1875 he became director of The American Nautical Almanac.

SIMON NEWCOMB'S TASK, WHICH TOOK OVER TWENTY YEARS

One of his most useful contributions to science was the work of reviewing and making over the existing theories and tables of the movements of the whole planetary system—an enormous task on which he spent more than twenty years. In addition to his heavy professional work Simon Newcomb was able to think and write on a variety of subjects; to produce books that were profound and books that were popular. He was both accurate and bold in making conclusions. Many distinctions were bestowed on him by learned bodies abroad and at home. And, having been granted the rank of rear-admiral several years before, he was given a military funeral when he died, in 1909.

Edward Emerson Barnard is another American who had little chance for study as a boy, but who loved the starry heavens and gazed at them with such purpose that he, in time, found doors opened to the greatest observatories in the land and won high honors. To him we owe the discovery of sixteen comets, a satellite of Jupiter and other bodies unknown before. He has given the world rare and revealing photographs of the Milky Way, of comets and of nebulæ.

A BOY ON A ROOF STUDIES THE STARS THROUGH A SPYGLASS

Born in Nashville, Tennessee, in 1857, Barnard had to begin work for a photographer when only eight years old. A book on astronomy, a spyglass and the roof of the photograph gallery started him upon his career. When he was twenty, he owned a small telescope, and, at the suggestion of Simon Newcomb, who happened to attend a meeting in Nashville, began to search for comets. His success brought him to the attention of the public. An opportunity for several years of combined study and observation was followed by an appointment on the staff of the Lick Observatory in California, which then had the greatest telescope in the world. Later Barnard became professor at the University of Chicago and astronomer at the Yerkes Observatory in Wisconsin.

It is interesting to know that his magnificent photographs of the Milky Way were made through a telescope which had only a six-inch opening and was fitted with an ordinary lens, at the Lick Observatory, where the famous thirty-six-inch refracting telescope stood close by. The boy who began acquaintance with the stars through a spyglass learned not to despise a modest instrument. A great intelligence may work wonders by means of the simplest tools.

The telescope, the spectroscope and the camera, as we have seen, each has pushed

men's vision farther and farther into the vastness of the star-strewn spaces. An astronomer now can get a photograph of a body so remote that the strongest telescope cannot reveal it to his eye directly. This has been called the "astronomy of the invisible." Another instrument, the photometer, is used to find out the relative brightness of stars, so that they can be listed in the order of their brilliance.

THE CAMERA GIVES US THE "ASTRONOMY OF THE INVISIBLE"

It was the undertaking of Edward Charles Pickering to survey by means of the photometer and the spectroscope the heavens of both the northern and the southern hemispheres. He was born in Boston in 1846, and began his special study of the brilliance of the stars in 1877, as director of the observatory at Harvard College, of which he was a graduate. After he had planned an improved instrument which would show the intensity of fainter lights, his list soon included more than a million stars. For the survey of the southern heavens an observatory was erected at Arequipa in the Andes Mountains, and the photometer put in use. There thousands of stars were listed.

By later study of the spectra of the stars in both hemispheres Professor Pickering gained very important results. Here the camera often helped the observers to discoveries. By photographs Professor Pickering made many charts of the skies, which are of great value to all astronomers. He lived until 1919.

THE YOUNGER OF TWO FAMOUS BROTHERS CHARTS THE MOON

A younger brother, William Henry Pickering, born in 1858, has traveled to various parts of the globe to make observations and to set up observatories. It was he who established the Arequipa Station in South America and erected Dr. Lowell's telescope at Flagstaff. He made a most successful photographic study of Orion's nebula, and his investigations with the camera led to his discovering two new satellites of Saturn. He also took a long step forward in the study of Mars, concluding that the dark patches represent, not bodies of water, but vegetation. On this theory Professor Lowell's ideas are based, as we have seen. For a time the two men worked together at Flagstaff.

But Professor William Pickering's most enthusiastic research has been centred upon the moon, which he has charted thoroughly and about which he has written several books. Visits to Hawaii and the Azores were made so that he might compare their craters with those of the moon. The atmosphere of Jamaica, in the West Indies, where he established a station for Harvard, he found most favorable for studying and photographing the moon. A love for mountain-climbing has taken this astronomer to the summits of a number of difficult peaks.

As William Henry Pickering found in the West Indies the best conditions for examining the moon, another energetic astronomer, George Ellery Hale, sought in southern California a mountain-top well suited for observing the sun. You will understand that being on a mountain-top is an advantage, not because the height is enough nearer the sun to count, but because the light does not have to travel through so many layers of our atmosphere as it would on a lower level.

A BUILDER OF OBSERVATORIES WHO STUDIES THE SUN

While still a student in the Massachusetts Institute of Technology young Hale had built a laboratory behind his father's house, where he could use the spectroscope. A few years later he was a professor at the University of Chicago, in which city he had been born in 1868. Before he was forty years old, he had planned and directed the building of two noble observatories, possessing the largest and most powerful telescopes in the world —Yerkes Observatory at Williams Bay, Wisconsin, and Mount Wilson Observatory in southern California. It is hard to imagine the difficulties of hauling to the top of this high mountain the heavy materials needed, and of setting them in place in spite of storms and melting snows.

But amid his other activities Professor Hale had found time to invent an instrument for studying the sun, the spectroheliograph, with which he has made most interesting and important discoveries about the great flaming star which is the centre of our system—its spots, its gases and its magnetic influence. Director, in turn, of the two great observatories he helped to erect, he has yet been able to take an influential part in scientific societies, to edit journals and to write articles and books on the topics of which he is a master.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 465.

An Egyptian design giving a rare study of geese.

THE ARTISTS OF THE OLD EMPIRES

CONTINUED FROM 196

THERE are few things more remarkable in the history of the world than the complete eclipse of the art of the reindeer-hunters when the Stone Age came to an end. The impulse that forced men to make those beautiful and simple pictures went out suddenly, like a candle flame.

The Stone Age, as we have seen, was a period of rough, rude existence, when wild animals supplied man's every need. The Bronze Age which followed lasted many thousands of years, and it would appear, looking at this stage of human development, that life was almost as simple then as in the Stone Age.

But in glancing back over the bounds and fields of Time as over a landscape, we see the Bronze Age in its true perspective. This slow-seeming period held nothing short of a revolution, for, early during its span, men discovered how to use and to grow corn, barley, millet and flax; and they learned to tame animals. The world has rolled on over a hundred centuries since then, but until the dawn of steam power there has been no development so vital to human life as these apparently simple discoveries of the far-off Bronze Age. Somewhat later men also discovered metal—first gold, then copper. Some happy accident led to the mixing of copper and tin, and so the name of the mixture—bronze—was given to the period. A little later again, the art of making pottery was discovered.

Many relics of daily life in Europe at this time have come to light. They show a certain skill in decoration, but nothing that can be called art. Yet the workmen of those days knew a good deal of the technique of engraving on metal, and we can judge their skill by the decorated swords, bracelets, daggers, plaques, and so on, which have been found. The potters also made rough patterns on their bowls and dishes. And the interesting thought that arises about these is that, crude though they may be, they mark the beginning of what we might call household decoration. Nearly all our cups and saucers and jugs and basins to-day bear some design. Now, you can see, this habit of making useful things attractive is about ten thousand years old.

In addition to these small objects the men of the Bronze Age left mysterious and huge decorated granite blocks, which they set up, generally in avenues of approach to their dolmens, or stone-built tombs.

The most famous of these are on the island of Gavr'inis, off the coast of Brittany. Other examples have been found in various other parts of France, in Denmark, Sweden, Spain

and Portugal. There is one fine specimen near Dublin in Ireland. All bear the peculiar stamp of the Bronze Age ideal of decoration; patterns made of repeated triangles, circles and crosses, and —in the dolmens—minute lines that follow one another much like those on sea-charts of a coast-line. We have been unable to find out why there was nothing alive represented among these patterns of geometric lines. Except for one or two clumsy attempts at engraved figures there is no representation of human or animal life. It would seem that superstition had laid a ban on the representation of living beings.

But for more advanced art in that distant period we must turn to Egypt. While the men of the Bronze Age on the continent of Europe were making their small, skillful patterns, a great national art was rising in the country of the Nile.

Egyptian art differs very greatly in quality from the art of any other early nation, because it was inspired by a definite system of religious thought. It is the first such art in the history of the world. It is the next big thing, in time, to the art of the reindeer-hunters, which, as we remember, was warm and natural and beautiful, and was the work of men who had thought very little. Egyptian art, however, was more cold and less natural, but beautiful—the work of men who had thought a very great deal.

THE TWO THOUSAND STRANGE GODS OF OLD EGYPT

The Egyptians had worked out for themselves a curious religion, a system embracing over two thousand gods and goddesses divided into certain families, or groups. If it had not been for their animal worship—there were many animal deities, and numerous birds, reptiles and insects were sacred—the religion of the Egyptians would have been lofty and rather wonderful. Some of the chief gods have interesting titles. There was Osiris, the man-god who rose from the dead, and was deified and became king of the other world and judge of the dead. There was Set, the principle of evil, the enemy of Osiris. There was Nu, the god of the watery mass whereof the world was made.

There were the goddesses of wisdom, of literature, of earth, sky, rain; almost every physical and mental force had its divinity in the old mental outlook of the Egyptians. Portraits of them are shown in the sacred books and paintings. Generally speaking, from the shoulders down they are very much alike, but are distinguished one from another by the most wonderful head-decorations.

These divinities imposed upon their subjects a certain way of thinking and behaving which had for a foundation two strong beliefs—that this world is of little account, save for the passing happiness it may afford, and that the wicked are punished and the good rewarded in the world to come. It was on the idea of the future life, of which they were so unwaveringly sure, that the Egyptians based most of their literature and art; and we cannot appreciate their paintings, their sculpture or their architecture without first understanding this fact.

THE OLD EGYPTIANS' RESTING ROOMS FOR THE LONG, LONG SILENCE

A Greek historian once said that the Egyptians looked on their houses as mere places of passage, and on their tombs as their permanent dwellings. They made tombs fit to outlast time itself, and in them buried their dead, wonderfully embalmed, so that the bodies would be preserved for thousands of years; and they placed in these houses of long silence very beautiful things. It seems strange to us that a nation should concentrate its art on its sepulchres, but perhaps we shall understand it better when we realize that to these far-off people death was only a suspension of life; sooner or later the spirit would return to the body.

This idea was so real to them that they furnished the house of the dead with as much tender care as if the dearly loved person had been alive. Tables, chairs, stools, beautifully decorated bowls for oils and spices, painted and inlaid boxes containing mirrors, hairpins and scents, were among the furniture of the tomb. In a child's tomb they placed its toys, in that of a warrior his spears, in that of a hunter his bows and arrows, in that of a state dignitary his staff of office.

THE LOVELY BOOK LEFT WITH THE DEAD FOR THEM TO READ

In all tombs of any importance they put a remarkable set of writings called the Book of the Dead, which was supposed to have been written in the first case by Thoth, the scribe of the gods. It contained religious teaching, stories of

the life of the gods, and so on. Each copy was separately written and painted by scribes and artists in bright colors and hieroglyphics—picture-words. And these men put into a work which would be seen by the spiritual eye of the dead all the skill generally put into pictures meant to win world-wide fame.

We can see the kind of illustrations that were painted in the Book of the Dead from the magnificent specimens shown in the Egyptian galleries of the British Museum. The collection of these papyri there is the finest in the world; and it brings back to us a race and a religion and an art that will have a definite place in history as long as history endures.

THE ROYAL TOMBS THAT MADE KINGS SEEM MORE KINGLY

The tombs on which so much time and art were spent were of various kinds: the mastabas of the earlier dynasties—heavy, rectangular constructions; the pyramids of the later centuries; and the rock-hewn tombs of the mountainous parts of the country. Of these last the most famous are the tombs of the kings at Biban-el-Muluk, near Luxor, on the banks of the Nile. The splendors within them make us feel that death had left royalty thrice royal.

Each tomb contained several chambers and passages, and, in some kinds, a shaft led to a remote chamber where the sealed sarcophagus was laid. There was generally placed in or near the tomb a statue of the dead, to which offerings were made. These tombs were built and endowed by the wealthy "for ever." In some there was a chamber where "the sad and solemn priests" made daily offerings for the dead. A temple built near the later tombs took the place of this room. The walls of the chambers, and in some cases the ceilings, were covered with interesting decorations showing men and animals, gods and goddesses. Figures were often outlined or engraved, sculptured in a slightly raised relief, or sunken.

WHERE THE DEAD WAIT IN QUIET HOPE OF THE LIFE TO COME

Usually the decoration was painted in brilliant coloring, and the colors have lasted so well that they are charming today. Often, above and below the rows or groups of figures are beautiful borders of conventional design, using the lotus, the papyrus and other motives. Almost every shape used was a symbol, and inscriptions in hieroglyphics added further to the richness of the pattern, as well as to the meaning of the whole.

The Egyptian artist had to follow strict rules which were prescribed by religious authority, and which were never cast aside. Everything is painted flat. No modeling is attempted; no light and shade shown; the backgrounds hold no suggestion of the laws of perspective. The figures are always intentionally "out of drawing," with faces, legs and feet in profile, and shoulders and bodies turned full-front. This distortion is all the more marked because the eye shown in the profile is always the eye as it would appear in a full view of the face. The feet were always shown flat to the ground. Any attempt at a light poise, a resting on the toes, or one foot flying, would have seemed to them a contradiction of their standards of art. After a little thought we see that it could not be otherwise. The whole spirit of Egyptian art is the clamping-down of a human being on the Rock of Eternity.

CALM AND REPOSE, THE KEYNOTES OF EGYPTIAN ART

The idea that life would go on forever crept into the work even when the artist had no thought of portraying anything of a religious kind. The keynote of their art, so to speak, is a quietness, a waiting, an immobility. In portraits and statues their kings and queens are often shown seated, knees together, feet together, no twist in neck or shoulders, eyes looking calmly out, the face in complete repose. If the figure is standing, it is pulled out to an abnormal length, and has the same movelessness of spirit. Egyptian art, alone in the world, is intensely still.

Wandering about the Egyptian rooms of the Metropolitan Museum in busy, modern New York, you can more than glimpse the life and art of ancient Egypt. You can stand within a tomb-chamber, with rows upon rows of painted scenes around you, and feel yourself in the presence of Egyptian men and women who came to lay gifts upon the offering-table before those painted false doors, from which the spirit of the departed might come forth at will. You can even see how the artist worked; for on the walls there are unfinished bits, showing where figures had been simply outlined in paint,

but not yet cut in relief or colored as they were finally to appear. These wall-paintings, the designs on mummy-cases, furniture and chests, and the exquisite jewelry of kings and queens will be proof enough of the Egyptians' love of color and their artists' skill in using it. And, as for their knowledge of nature, their unsurpassed drawings of birds and their expressive studies of animals cannot fail to make us feel how true and sympathetic their vision must have been.

In the stories beginning on pages 647 and 807 you will find the thrilling tales of some of these old, old treasures that have been brought to light for us after lying buried and unknown for centuries; how not only Egypt, but its neighbor and rival countries, Assyria and Babylonia, across the sands in Asia, have opened before our twentieth-century eyes and minds a storehouse of wonder.

THE FRIEZE OF THE ARCHERS OF DARIUS

> For to-day is asking with pick and spade
> Of yesterday's name and race.

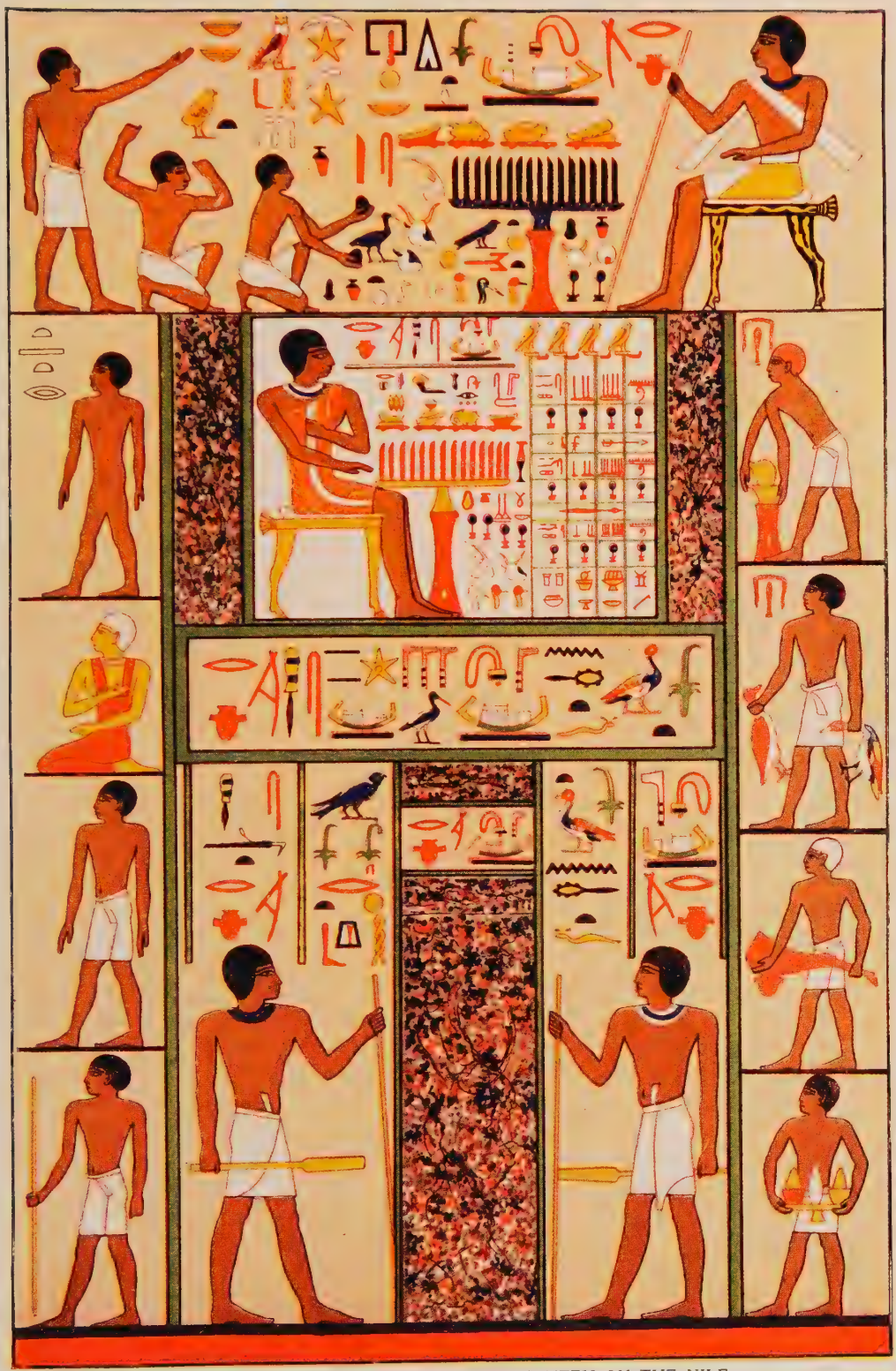
Nearly four thousand years ago a king built lordly temple halls to the glory of himself and his gods. Or, again, a king was buried in state in his tomb by the banks of the Nile. In our own day that vast columned temple reveals to us the thoughts of the far past; the seals of the tomb are broken and its splendid royal trappings become a central interest for the whole world for a time. Not quite three thousand years ago an Assyrian ruler established a great library at Nineveh; and then a Babylonian monarch built shining palaces on the plains of the Euphrates. In these later years, men have dug into the hills of time and unearthed the stone bas-reliefs of the library's walls and thousands of little clay tablets that were the volumes on its shelves. Other men have gathered and pieced together fragments of broken tiles, until we can see the beautiful colored design that adorned the wall of a palace in Babylon. So, the works of ancient rulers—Rameses and Tut-ankh-Amen, Ashur-bani-pal and Nebuchadnezzar—are brought close to us after having been lost to history for ages.

Color was used for wall-decoration in Babylonia and Assyria as well as in Egypt. In the palaces of Assyria, which was a hill country with a supply of stone, the brick walls of the buildings were often faced with slabs of limestone or alabaster, carved in relief. Sometimes, however, the bricks were simply coated with plaster and this was covered with paintings. In Babylonia, a land of level plains, where stone was scarce, the characteristic finish for decorated walls was that of glazed tiles, some of which had the design raised like a relief, while some were flat, depending upon color alone to

A PORTRAIT FROM ONE OF THE OLDEST PICTURE GALLERIES IN THE WORLD: KING SIPHTAH OF EGYPT, FROM THE MILES OF PAINTED WALLS AND CEILINGS LEADING TO THE TOMBS IN THE VALLEY OF THE KINGS

This fine piece of Egyptian color was rescued in the excavations carried on at Biban-el-Muluk by the generosity of Mr. Theodore Davis.

PAGE FROM THE BOOK OF THE DEAD, LEFT IN THE TOMBS OF EGYPT FOR THE DEAD TO READ



THE PAINTED WALLS OF A TOMB AT GIZEH ON THE NILE

A KING'S PALACE IN ASSYRIA IN THE DAYS WHEN NINEVEH WAS A GLORIOUS AND ACTIVE CITY

show the pattern. In both countries the colors used were brilliant and gay but were not intended to give the effect of nature. Blue, yellow and white were the colors most commonly used. Of these, blue was usually employed for the background, although green sometimes took its place.

Lions frequently appear on the decorative friezes, almost always nobly and vigorously pictured. Two fine examples illustrate very well the color schemes of the old artists in enamel work. First, a lion from a palace at Khorsabad in Assyria is bright yellow against a ground of intense blue, with the mane and some of the muscles brought out in the same strong blue.

The other, belonging to old Babylon, is white with a yellow mane, and stands out against a background of blue. In each case there is a charming border of white rosettes with yellow centres. The Babylonian lion is one of an interesting procession of the kingly beasts forming a frieze on each side of a magnificent festival road built by Nebuchadnezzar from the temple of Marduk, past his own palace, and so on to the Euphrates. Along this road the god Marduk was carried, once a year, to visit the god Nebo on the other side of the river. This lion frieze is probably the highest accomplishment in the art of brick-enameling. Enamel was used in Assyria, too, but was not of as fine a quality as that which has been found in Babylon.

Other creatures besides the lion—bulls, dragons, birds and mythical monsters—decorated the gateways and side-walls in both countries. The palaces were adorned with spirited scenes of warfare and triumph, or of huntsmen on horseback or in chariots pursuing lions and wild boars—a record of the glories of the kings, their victories and their prowess. For, as the underlying feeling of Egyptian art is that of *duration,* so the idea most often and most clearly expressed by the Assyrian is *strength*—strength in action, brute force in full play.

For borders there was a variety of designs. One favorite showed a spiral twist; others were conventionalized flower patterns. All these occur on colored pottery, much of it black, with the lines of the design cut into the surface when it was soft. Then these cut-in lines were filled with a white paste before the clay was baked. The decorations might be in the shapes of fish, boats, waterfowl or geometrical figures. In other cases, stripes of various colors were painted on the bowl or jar by way of ornament.

The art of the Persians closely followed the same lines as that of the Assyrians and Babylonians, with added richness of form and jewel-like radiance of color for their own contribution, and a certain delicacy which indicates Greek influence.

Two very beautiful specimens of their enameled brick friezes are pictured here for you. In one you see a section of a lion frieze resembling those of the older kingdoms; the other shows a line of archers. Both are from the palace of Darius at Susa—"Shushan the palace," of which we read in the old Bible story of brave Queen Esther, whose husband "King Ahasuerus" was probably the Persian king Xerxes, the son of Darius, who organized the empire.

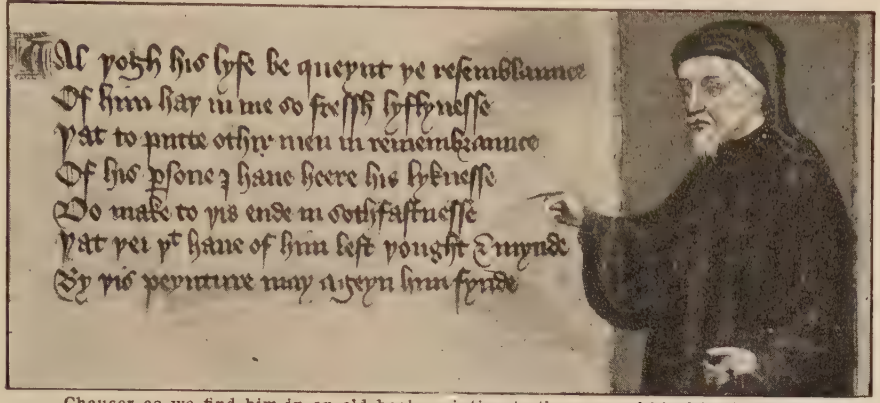
THE NEXT STORY OF THE FINE ARTS IS ON PAGE 447.

A LION FROM A FRIEZE IN THE PALACE OF DARIUS AT SUSA

THE FATHER OF ENGLISH POETRY

GEOFFREY CHAUCER READING POEMS FROM HIS CANTERBURY TALES AT THE COURT OF EDWARD III

Chaucer, the first great English poet, lived in the 14th century, before the days of printing. The poet was a favorite at the court of King Edward III, and at times would read his poems before the king and his courtiers, in the way which Ford Madox Brown, the celebrated painter, has illustrated so happily in this picture.


Al posh his lyfe be queynt pe resemblaunce
Of him ſtay in me so freſſh lyffynesſe
Pat to purte othir men in remembraunce
Of his pſone I haue heere his lyknesſe
Do make to pis ende in ostisfastuesſe
Pat pei pt haue of him lest ponght & mynde
By pis peynture may ageyn him fynde

Chaucer as we find him in an old book, pointing to the poem of his friend Occleve.

MEN WHO FIRST WROTE ENGLISH

HOW THE FIRST ENGLISH BOOKS FIXED THE LANGUAGE

CONTINUED FROM 217

WHEN we speak of Chaucer as the "father of English literature," we do not of course mean that he was the first writer known in England. We simply mean that, although many men wrote English before his time, he was the first great author who wrote in English that we can read with ease and pleasure.

In the Book of Stories we read the fine story of Beowulf. This is the first English poem that we have. It was sung in the banquet halls of England long before the great king Alfred reigned. We have a manuscript copy of this poem, which was made perhaps about King Alfred's time, but it was written in what is known as Anglo-Saxon or Old English.

Bede, about whom we read on page 126, translated the Gospel of St. John into English. He also wrote a charming history of the English nation to his own time, about two hundred years before King Alfred lived. The history was written in Latin, but it is as easy for us to read the book in that language as it is to read the translation which King Alfred made into the English language as it was spoken in his southern English kingdom of Wessex.

Alfred, who was not only a great king but a good writer and a great educator, spent his leisure moments in writing and translating books, so that his people might have books to read in their own language. It was this great man who gave instructions for the record of events called the Anglo-Saxon Chronicle, which was written in the monasteries. Records were made in it until after the Norman Conquest, and though the entries are short, it has helped us to learn the history of the time.

After Alfred and the writers of his time died, there was a blank in English literature. The attention of the men of the next century and a half was occupied with the struggle with the Danes. Then came the Norman Conquest, and for a long time the English language was looked upon with disdain as the tongue of a conquered people.

But we are mistaken if we think that *no* literature was produced in English, through books or by word of mouth, during those fierce and turbulent times. In the monasteries patient monks, proud of their skill as penmen and painters, were busy with the chronicles of their day. Tale-tellers or

harpers wandered about the country from hall to hall, from fair to fair, and from inn to inn, singing or reciting ballads, new and old, for the amusement of their hosts or companions. Plays, clumsily made from Scriptural incidents or romantic adventures, were acted by the peasantry or by guilds of workmen in the towns, and thus old-time legends were preserved and developed, together with the doings of kings, religious instruction, and songs, lively or sad. In this way, though no great writer lived in these centuries, simple forms of literature were circulated.

The popular tales of the times passed from country to country, and were recast, added to, and ornamented as they traveled. English and Welsh stories were written down in France and then brought back into England, or were turned into Latin by monks. Four or five sets of these stories can be distinguished—the Greek accounts of the siege of Troy, the adventures of Alexander the Great, the heroic deeds of King Arthur, the history of Charlemagne, and later the greenwood adventures of Robin Hood. France was the great workshop for tale-making, and French the language of romance. French was made the language of the palace, the castle and the law court. French, not English, was taught in the monasteries, which were the schools of the time. Gradually the native language suffered change. Grammatical forms were altered. The use of many French words crept in, and the English of the fourteenth century had become so different from the old Saxon English that King Alfred could not have read it.

GEOFFREY CHAUCER, WHO FIXED THE LANGUAGE THAT WE SPEAK

But all the while English remained the speech of the great bulk of the people. The descendants of the Norman barons, who prided themselves on being English, began to look upon the English language as their own.

Slowly one of the dialects of English—the East Midland, which was spoken in London—gained the mastery, and began to be regarded as standard English. The English kings ceased to feel like Frenchmen. English was spoken more and more by all classes. It was again made the language of the courts of law. Poets began to write in it. The time had come for someone to establish forever the language, by using it in books that all men would read. The man who did this work was Geoffrey Chaucer.

Chaucer was born in London, by the side of the Thames, but *when* is one of the puzzles of history. For centuries the date was believed to be 1328, but more facts keep coming to light, and now we know it could not have been 1328, but probably was 1340, or thereabouts. We know this because in 1357 Chaucer was page to the wife of Prince Lionel, son of Edward III, and she spent about twenty-five dollars of our money to buy him a suit of clothes, including a pair of red and black breeches.

THE BOY WHO GREW UP TO BE REMEMBERED FOREVER

Chaucer was just the man to write poems picturing all the different kinds of people living in his day, for he saw much of the world. His father, a wine merchant, was connected by business with the king's court. As a boy the poet had a sound education, to which his experience as a page added manners and a gentle bearing. While he was yet in his teens he went to France with the army of Edward III, and was taken prisoner, but ransomed. The king himself paid a part of the cost.

Six years later Chaucer was one of the "valets of the king's chamber," and afterwards, when between thirty and forty, he crossed to the Continent seven times on the king's service, and once remained in Italy nearly a year. At the height of his prosperity the poet sat in Parliament, but his fortunes declined with those of his faithful friend John of Gaunt.

Chaucer was not only a man of learning but a man of the world, trusted by the greatest of his day, and a traveler of wide experience. His writings show the influence of his travels. At first he translated and imitated the French poets. Then he was captivated by Dante, the greatest poet of the Middle Ages, and by Petrarch, whom he probably met in Italy. But though his later poems often borrowed both their form and their subjects from Italian works, they became increasingly English in thought and original in treatment.

CHAUCER'S PICTURES OF HIMSELF IN HIS POEMS

Before asking what kind of man this Chaucer was in appearance, let us learn how to read his verse—an easy matter if we notice two or three points.

Some of his words have passed out of use, or have changed their meaning, and we may have to look for their old meanings in a glossary. Many words were spelled out more fully than now, and had an extra syllable—as *newë* for new, *bookës* for books, and *gamë* for game. Then words borrowed from the French kept the emphasis on the last syllable, as rea*son* for reason, and vir*tue* for virtue. Also *tion* endings are not pronounced as *shon*, but in the French way, as if they had two syllables and were spoken *ce-on*. On this page you will find some extracts from his poems which show that by taking a little trouble we can read them for ourselves.

If we fill in from other personal jottings the picture of himself Chaucer has outlined in his writings, we see him stout in body, pleasantly roguish in face, quiet and retiring, though a man of the world with bright eyes that miss nothing.

Though a student deeply in love with books, he is no hermit, but takes cheerfully whatever life comes to him among his fellow-men, and thanks God for it. He cannot resist the chance of poking quiet fun even at men whom he admires. His best mood comes in response to the call of spring. Then he goes out of doors, and is charmed by the flowers and the small birds. Most of all, he loves the modest daisy. Nothing but death, he says, can take the love of this flower from his heart.

This is how this gentle writer is invited to step forward and show himself among the pilgrims of his Canterbury Tales:

Thou lokest as thou woldest finde an hare,
For ever up-on ground I see thee stare.
Approche neer, and loke up merily.
Now war yow, sirs, and lat this man have
place;
He in the waast is shape as wel as I;
This were a popet in an arm t'enbrace
For any woman, smal and fair of face.
He seemeth elvish by his contenaunce.

The Pilgrims on their way to Canterbury—the last rider is Chaucer.

In another poem he is described as buried in his books when his day's business is over.

But of thy verray neyghebores,
That dwellen almost at thy dores,
Thou herest neither that ne this;
For whan thy labour doon al is,
And hast y-maad thy rekeninges,
In stede of reste and newe thinges,
Thou gost hoom to thy hous anoon;
And, also domb as any stoon,
Thou sittest at another boke,
Til fully daswed is thy loke,
And livest thus as an hermyte,
Although thyn abstinence is lyte.

Below Chaucer again views himself among his books. Remember that *lyte* means little, *foules* means birds, and *war yow* means make way.

So hertely, that ther is game noon
That fro my bokes maketh me to goon,
But hit be seldom, on the holyday;
Save, certeynly, whan that the month of May
Is comen, and that I here the foules singe,
And that the floures ginnen for to springe,
Farwel my book and my devocioun!

The poet's writings fill seven hundred pages of close print, but the poems that picture him for us at his best are a collection called The Canterbury Tales, which he had not finished when he died.

Caxton showing a book to the Abbot of Westminster.

The plan of these tales gave the poet freedom to choose characters from the rich, the middle classes and the poor, and bring them together under circumstances that made them friendly, yet left them natural and independent.

A company of about thirty men and women, the poet imagines, have met on an April day at the Tabard Inn, in Southwark, over the Thames from London, to start on a pilgrimage to the tomb of Thomas à Becket at Canterbury. They made a merry group, bent on enjoyment as well as religious duty; and the landlord of the inn, a jovial, managing fellow, volunteers to act as their guide. To pass the time pleasantly as they travel on horseback at a walking pace, he proposes that each pilgrim shall tell two stories on the way to Canterbury, and two on the return journey. Whoever tells the best story, the landlord being the judge, is to be entertained at supper by the rest of the company when they return to the Tabard.

The poet describes each of the pilgrims, and writes the stories they tell, but only twenty-four. Before they reached Canterbury the tales broke off, owing to the poet's death, and we do not hear which story won the prize.

In these tales, supposed to be told by all kinds of people, the manner in which people lived in the Middle Ages is unrolled before our eyes like a vast panorama. We see it just as it was, sometimes gentle and romantic, sometimes brutal, cunning and vulgar, with good and evil so mixed that we do not know whether to laugh most or lament most at the sight. You can feel that Chaucer greatly enjoyed telling these stories, for all the while he was full of fun and high spirits. He could not help making fun of himself, as when called forward to tell his own story, he started a long, romantic rhyme of love, Sir Thopas, such as he had in his youth translated from the French, and the landlord stopped him abruptly by exclaiming, "No more of this!"

What a mixed company it is that gathers under the guidance of the jolly innkeeper! There is the knight, who has ridden through many lands to fight for love and chivalry and honor, freedom and courtesy, and who yet, in his bearing, is "as meek as is a maid." With him is his

son, a curly-headed lad of twenty, his dress as gay as a flower garden, his mind full of love and romance, but not in sadness, for—

Singing he was and fluting all the day,
He was as fresh as is the month of May.

As a squire the young man has "borne him well" in France and the Low Countries, and, like the knight, is a gentleman in heart and bearing.

Courteous he was, lowly and serviceable,
And carved before his father at the table.

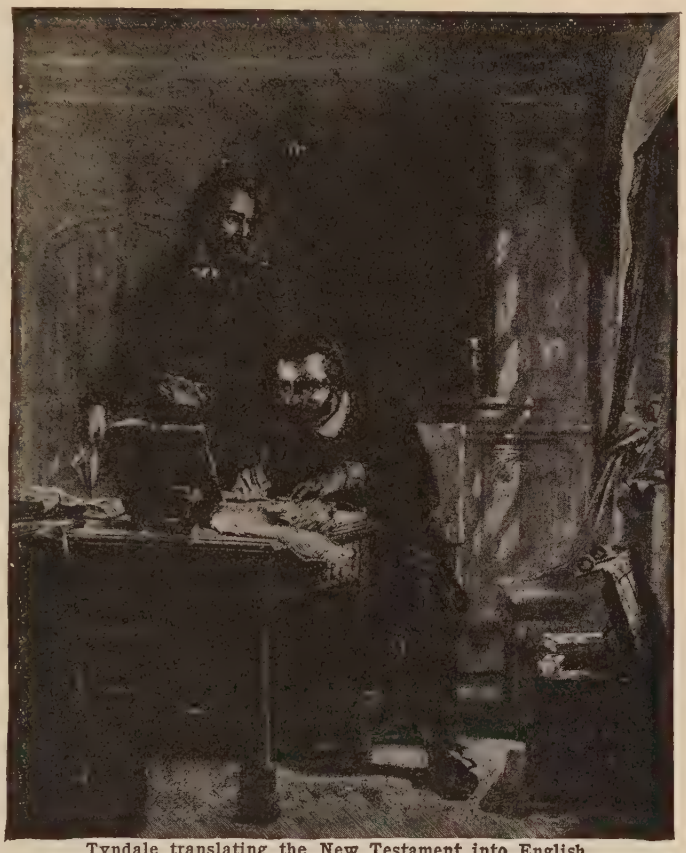
The knight and the squire are attended by an honest yeoman, bow in hand. The Church contributes a group of characters, the chief among them being a prioress, who is a model of the best manners of the day, eating with cleanness and delicacy, and wiping her lips carefully "when she drunken hath her draught." Besides, there is a worldly-minded, sport-loving monk; a wandering friar, the best beggar in the whole countryside; a red-faced tax-collector; a pardoner; and a devoted parish priest, who, staff in hand, walks in all weathers from end to end of his parish, visiting great and small in their sickness, teaching Christ's Gospel, "but first he followed it himself." Though poor, this parson is "rich in holy thought and work."

Benign he was and wonder diligent,
And in adversity full patient,
To drawen souls to heaven by fairness,
By good example was his busyness.

The professions provide a doctor, with more than a suspicion of quackery in his talk; a lawyer, who is not so busy as he tries to appear; and a pale, threadbare student from Oxford, who would rather have books than gay clothes. His mind is bent wholly on study, and he speaks with well-formed sentences.

Sounding in moral virtue was his speech,
And gladly would he learn and gladly teach.

The landed classes sent to the pilgrim group a farmer; commerce sent a merchant; and among the rest were a miller, a ploughman, a sailor, a carpenter, a weaver, a dyer, and a wife of Bath who had been married five times. The whole range of manners of the times, of good taste and of bad taste, is covered by these living figures.



Tyndale translating the New Testament into English.

Most of the tales were borrowed from Italian writers, but in turning them into English Chaucer gave them freshness and even new meanings. Good nature and a quiet humor played over all his writing, but he taught serious natural duties like contentment:

Look up on high, and thank thy God for all,

and a still loftier duty of faithfulness to the best thoughts that visit us:

Hold the high way, and let thy soul thee lead.

Caxton, who printed books in the English tongue seventy-seven years after Chaucer's death, printed some of the poet's works seventy-eight years after his death, and introduced them by saying: "We ought to give singular laud (praise) unto that noble and great philosopher who may well have the name of laureate-poet." With that judgment all later users of the English language agree; for Geoffrey Chaucer not only wrote pleasant poems, but pictured the people of his own day and helped to fix our tongue, which had been changing constantly.

THE TALES TOLD BY THE COMMON FOLK

While Chaucer was writing poems for fashionable people to read in expensively copied books, the common folk were telling each other tales in ballads—simple rhymes, often stumbling along. Then again they move our hearts with strong, clear picture-words, or haunt us with recurring phrases or refrains. When printing was invented these ballads were among the first poetry circulated everywhere, and one set, that told the story of the bold outlaw Robin Hood and his merry men, was so well known that a poet, Michael Drayton, writing a century later, said of Robin:

In this our spacious isle, I think there is not one
But he hath heard some talk of him and Little John.

We can read, as an example, the ballad recording the tradition that Robin Hood was bled to death, when ill, by a treacherous kinswoman, the prioress of Kirklees, or Kirkley, nunnery. It shows how limping the metre often was, and yet how sad, how vivid, and how powerful the simple verses became when feeling was strong in them.

VOIAGE AND TRAVAILE OF SIR JOHN MANDEVILLE

There were other writers of English about Chaucer's time of whom we shall speak, but first we must go back to a very famous book, The Voiage and Travaile of Sir John Mandeville. This book, however, was not written in English. It was written in French about the time that Chaucer was a page. For centuries people thought that the book had been written by an Englishman, Sir John Mandeville, but scholars now tell us that it was written at Liége by a man whose name was Jehan de Bourgoyne. He was generally known as Jehan à la Barbe, and was probably a physician. He may not have been an Englishman at all, but it is possible that he was, and that he had to go into exile for a political offense. It is certain that the author of the book had been a great traveler for his time, and that he had been in Egypt. For a long time it was thought that the author himself translated his book into English, and although we do not now think that he did this, we still speak of it as an English book, for it was translated by someone, probably in the lifetime of the writer, and certainly in the lifetime of Chaucer. It is a marvelous account of travels in Egypt and Asia, and describes some things that the writer saw, some he could only have heard or read, and many things that he believed or imagined, but which never existed. It is thought that he died only a few years before the death of Chaucer.

JOHN GOWER, WHO LIVED WHEN CHAUCER DID

John Gower, who was one of Chaucer's friends, was a writer of English when Chaucer was a youth. He was probably about ten years older than Chaucer, and, as he lived about eight years after Chaucer's death, he was an old man when he died. He was not a genius like Chaucer, and his poems are not interesting to everyone, but he wrote good poetry, and always placed himself on the side of right. He, too, helped to settle the form of the English language, a work that had already begun before his time, although it was not finished until about Shakespeare's day.

Gower was born about 1330, and died in 1408. In his youth he wrote in French and Latin, but in his later years he wrote in English.

It is possible that Chaucer also knew John Wyclif, for the latter lived under the protection of John of Gaunt. John Wyclif was born in Yorkshire about 1320 and died in 1384. He went to Oxford University, where he studied at the famous Balliol College, and became a priest and, for his time, a very learned man. He was noted in his early days as a philosopher, and is famous in history

as the man who may be said to have begun the movement which is known as the Reformation of the Church. He wrote sermons and tracts on the state of the Church, and his writing is of interest chiefly to students of history and English literature. But he was one of the writers who in the fourteenth century helped to accustom people to read in their native tongue, and so helped to create a demand for books in English. As we have learned on page 473, Wyclif probably directed the first full translation of the Bible into English, and it is probable that he translated some of it himself. No fewer than 170 manuscripts of his version are still in existence.

THE VISION OF PIERS PLOWMAN

A very famous poem has come down to us from Chaucer's time, of which we must not forget to tell. This is the Vision of Piers Plowman, from which we have learned much of what we know about the sadness and misery of the lives of the poor people of that day. It is written in the form of a vision or dream, and deals severely with the sins and evils of the time. Although it was written about the time that Chaucer was writing his poems, a large number of the words used are strange to our ears, and it is much more difficult to read.

We know nothing, except what the poem tells us, about the author and his life, and indeed it may have been written by more than one person. It is generally believed, however, that at least the most important part was written by a man named William Langland, or Langley, who was born before Chaucer and died in the same year that Chaucer died. It is thought that he lived at some time of his life in London, but he also knew the country well, else he could not have written as he did of the life of the people. He was probably a priest.

HOW CAXTON SAVED THE STORY OF KING ARTHUR FOR THE WORLD

It is interesting to remember that although books on religion, history, science and law were written in prose, nearly every story that has come down to us from the time of which we have been reading was written in verse. Perhaps men had not yet gained enough skill in the use of their language to write stories in prose and make them interesting. Perhaps they had not gone far enough away from the time when stories were not written but were sung by minstrels to the music of their harps, to make an attempt at writing stories in prose.

Chaucer himself wrote some prose. Two of the Canterbury Tales are in prose. He translated a little book called The Consolations, by Boethius, a Roman philosopher, and he wrote a scientific treatise for his son, whom he lovingly calls "Litel Lowis, my sone," and commends for his ability to learn the science of numbers and proportions, and his love of knowledge. The poet shows himself to us here as a loving father, proud of his little son; but he has not left us a model for prose writing. Latin was then the language universally used by scholars, who corresponded with one another in it and wrote learned books in it, because it was understood by every man who went to college, or was taught in the monastery schools. English prose writing was left to less learned men, and though in the course of a century and a half after Chaucer's time it became beautifully clear and simple, the progress at first was very slow.

It is not until about seventy years after Chaucer's death that what may be called the first real book in English prose was written. This is the Morte d'Arthur, which was written by Sir Thomas Malory.

It might not have come down to us if William Caxton had not been so moved by its charm that he saved it for us by printing it on the press which, as we read on page 3386, he set up under the shadow of Westminster Abbey.

AN UNKNOWN MAN WHO WROTE A VERY FAMOUS BOOK

We know nothing about Sir Thomas except what he has told us himself, that his book was ended in the ninth year of the reign of King Edward IV of England. Morte d'Arthur has come to us only through Caxton's printing. The manuscript copies are lost. In it Malory tells, in clear, simple, romantic and enchanting English, all the legends that cluster round the memory of the British King Arthur, and it remains to this day one of the loveliest books of all the literatures of the world, a storehouse in which the poets, from Milton to the present, have sought for themes.

As the years passed, the Bible, with its nobility of thought, its unrivaled variety of style—narrative, history, drama, impassioned oratory, purest poetry and

simplest talk—became the textbook of the people.

WILLIAM TYNDALE, WHO TRANSLATED THE BIBLE INTO ENGLISH

For many years people were satisfied with the translation of the Bible which had been made in Wyclif's time. But as time went on it was seen that the translation was not good, and a priest named William Tyndale commenced to translate it anew. William Tyndale was born about 1492, nearly a hundred years after Chaucer's death. Like Wyclif, he went to Oxford University, where he took his degree, and afterward went to Cambridge University, where apparently he studied for some years.

He commenced his translation about the year 1523, but after he had been at work for some time, he found that he would not be allowed to publish it in England. He therefore went to Germany and lived for a time at Cologne. Then he went to Worms, and when he was threatened with arrest at Worms, he went to Antwerp. He worked hard for years at his translation, and part of it had been printed, but in 1535 he was arrested on a charge of heresy, and the next year he was put to death. He had not finished the work that he had set himself to do, but he had done a great work. The translation he had begun so well was finished by Miles Coverdale, and was used as the foundation of the great translation made in the reign of James I, about which we read in the next chapter.

Another writer whom we must mention here is Sir Thomas More, the author of Utopia, a book on the government of men and how they should live together. It is a thoughtful work, and some of the ideas which the writer expressed have in our own time been actually made to work. It is the story of an imaginary island republic in which everyone worked, all the people were happy, and the time not spent in labor was used in the improvement of their minds.

Thomas More, the writer of Utopia, was about fourteen years old when America was discovered. Like his father, he became a lawyer, and was so distinguished in his profession that he was made a member of the king's council. Henry VIII showed him great favor, and made him lord chancellor when Wolsey fell from power. But though Henry took delight in his wise counsels, Sir Thomas shrank from friendship with the king, for he knew the dangers to be feared from his fickle-mindedness. These forebodings proved to be true. Because More did not approve of the king's acts, Henry had him arrested for treason, and he was tried and beheaded for an offense which he had not committed. His famous book, Utopia, was written in Latin, and though he wrote many books, we cannot call him a great writer of English.

With the exception of Sir Thomas Malory and Tyndale, and perhaps Miles Coverdale, there are no writers of English whose names are worthy of being singled out during the fifteenth and the early part of the sixteenth century. During all this time people were gaining too much new knowledge to do great writing. What is called the New Learning had begun to filter through Europe. The navigators sent out by Portugal and Spain made great discoveries. Everywhere men's minds were waking to the fact that there were things to learn and beauties in the world of which their fathers had had no idea in the older days.

At first they were almost afraid of the new knowledge, and then their minds were so filled with the wonder of the truths and facts that they had learned that they could scarcely express their thoughts in words. It was not until late Tudor times, when all this learning had become absorbed and been made part of the national life, that the great poets burst forth into the songs that ever since have been the glory of our English tongue.

Meanwhile the language was gaining in strength and dignity. Utopia was translated in 1550, by Ralph Robinson. About the same time the beautiful Book of Common Prayer of the English Church was compiled and put into English, and in the religious disputes of the times the great preachers learned to write their sermons or homilies with an earnestness and sincerity that gave nobility to their work.

When Chaucer died, in the year 1400, English poetry had attained a charm unknown in prose. When Queen Mary came to the throne, in 1553, English prose had acquired a grace, sweetness and strength that it has scarcely surpassed since, while in poetry a stately edifice has been built on the plain foundations that Geoffrey Chaucer laid.

THE NEXT STORY OF LITERATURE IS ON PAGE 473.

WHY DOES A MATCH STRIKE?

CONTINUED FROM 188

A MATCH strikes because we make it warm by rubbing it on something. You know that you have to rub it against something rather rough, so that there is a good deal of friction. The movement of the match is hindered by the rough thing you press it against, and that is what we mean by friction. This makes the match hot. Rub the tip of your finger on your coat, and you will soon make your finger hot.

Now, the whole thing about the match is that its head is made of a mixture of things to which nothing happens as long as they are kept ordinarily cool, but as soon as they are made hot enough they catch fire—that is to say, they combine with the oxygen of the air, and so burn.

Our business, then, is to get a kind of mixture that will stay on the end of a piece of wood, or some such thing, and will catch fire even when made only so hot as we can make it by rubbing. Over a hundred years ago the first friction-match was made, and almost the best of these at first required a lot of friction, for it had to be drawn up between two pieces of sand-paper before it would catch fire. Then the curious element called phosphorus, which really means light-bearer, began to be used, and matches were made very much like those we use now. The special peculiarity of phosphorus is that it readily catches fire just as we want it to do, but a number of other things are put into the match-head, and especially something which itself contains oxygen, and can supply it for purposes of burning even more readily than the oxygen of the air. That is why you get a little explosion when you strike a match.

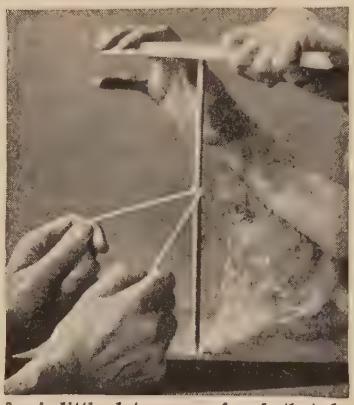
But of course there is a certain amount of danger in having anything about you that will catch fire so readily. Thus, if you have ordinary matches loose in your pocket, they may get rubbed together accidentally and they may catch fire. Therefore, it was a question whether there could not be made some kind of match which could be struck quite readily, but of which we could be sure that it would strike only when we really meant it to strike.

This kind of match was invented more than fifty years ago. Generally they are called safety-matches. The point about them is that there is no phosphorus in their heads; the phosphorus is put on the outside of the box instead, and so this kind of match is almost certain not to catch on fire except when it is purposely struck where the phosphorus is. Now, there are at least two different kinds of phosphorus, and the commonest and cheapest of these, white or yellow phosphorus, is a very deadly poison.

THE EARLIEST WAYS OF MAKING A FIRE

1. There was once a time, very long ago, when man did not know how to strike a light or make a fire to warm himself or to cook his food. But one day he found out that by rubbing dry wood together he could produce enough heat to set light to dry grass or moss and thus make a fire.

2. Another way in which man rubbed the wood was to twirl a dry stick in a hole, or socket, cut in a dry plank or tree-trunk. This picture shows the rapid twist which causes smoke to rise.



3. A little later man found that by using a socketed piece of wood to hold his fire-stick and getting a friend to pull the stick round, it could be made to revolve more rapidly.

4. Man then learned to make fire without help by holding his socketed stick in one hand and pulling the string with the other, attaching the other end of the string to the cord of his bow, which he fixed at a convenient place. When he left off pulling, the stretching of the bow pulled the string back.

5. Another way in which man made fire was to cut a slot in a piece of bamboo and saw this slot with another piece of bamboo. Little fragments were worked off, and the friction caused these to catch fire. Man made a great step toward matches when he discovered that by striking a piece of metallic stone against a flint he caused a spark to fall. He used to catch the sparks upon a little heap of dry moss.

HOW MAN LEARNED TO STRIKE A LIGHT

6. When iron and steel became known to man, he was able to improve his fire-making outfit. He had a rough box in which to keep his piece of flint, his steel, and the half-burnt cloth, called tinder, upon which he caught his sparks. The steel was struck upon the flint, driving a spark into the box, from which thin smoke is rising, showing that the tinder is smoldering.

7. This is a tinder-box like a pistol. A piece of flint struck against the upright steel, and a spark fell into a box below so rapidly that wind or rain could not put it out. A bundle of sulphur-tipped wood matches is below.

8. The first match at all like those which we use was invented by a Frenchman named Chancel in 1805. The chemicals which formed its head burst into flame when dipped into a bottle of acid.

9. A little later these matches came into use. Each was made of rolled-up paper, the tip being dipped in a chemical preparation. Within the tip was a tiny glass bulb of acid. When this was broken by pressure between pincers the acid escaped, mingled with the chemicals, and set fire to them.

10. The first practical lucifer match was invented by John Walker, an Englishman. It was very like those which we use to-day, and was struck by drawing it through a piece of folded sandpaper. These matches were sold at twelve a penny.

11. The safety-match strikes easily and is safe. It is one of the simplest and tiniest of things, yet it took man hundreds of years to invent it.

One grain of it may easily kill a man. People have often been killed by swallowing match-heads. Further, this dangerous kind of phosphorus was used in the heads of ordinary matches, and the people who made those matches used often to suffer great damage from phosphorus-poisoning.

However, the Belgian Government once offered a big prize for a "strike-anywhere" match that would contain no poisonous phosphorus. Two Frenchmen succeeded in doing this, and now these safe matches are being used more and more every year. Special laws are now in force in many countries forbidding the use of the dangerous white phosphorus in the match industry. Very soon all civilized countries will stop altogether the use of poisonous phosphorus in match-making. This will save the lives of many who work at making matches.

WHY DO WE FEAR A BEETLE WHEN WE KNOW IT CANNOT HARM US?

This is one of the most interesting of questions, because the answer to it takes us into the depths of our minds. What we call our reason, or intelligence, is in many ways the highest part of our minds; but it is not the whole of them. It is, in a sense, a new thing, and its power is limited by the fact that there are other parts of the mind far more ancient which have to be reckoned with as well. Most of these we may simply call instincts, and again and again we find, when we observe ourselves and other people, that the instinct of curiosity or of flight decides our actions quite apart from our reason.

Very often indeed the part of us that knows does little more than just sit still, so to speak, and look on and notice what the rest does. If we think, we shall see that we could not live if we had only our reason. To begin with, a baby would not suck, for there would be nothing to make it do so; and so it would be in a hundred ways throughout life.

But often our instincts may mislead us, though usually they guide us rightly; and so we may have the instinct of flight and the feeling of fear which goes with it when we see a beetle or a spider; and then we may be able to notice that, whatever the knowing part of us says, there is something else in us, older and stronger, which has its way and makes us afraid. Even now it is highly desirable that we should dislike crawling and creeping things; many may be harmless, but many others are very dangerous in various ways; and, on the whole, this instinct is a very useful and wise one for us to have.

WHY DO WE SAY THAT SUGAR IS SWEET?

This is a question which can be answered *in a way*, yet cannot be really answered at all. We know that there is a certain well-marked part of the surface of the brain which is the real seat of the sense of taste. From, or to, this place there run at least four, perhaps more, sets of nerves, which at their other ends we find in the "taste bulbs" of the tongue and part of the throat. One set of these nerves, when it is excited, arouses in the brain the feeling which we call a sweet taste, and the thing which specially excites this particular set of nerves is sugar.

But no one has the least idea why sugar should not taste salt, or why salt should not taste sweet or bitter; nor is there any imaginable way of describing a sweet, a salt, or bitter, or acid taste to anyone who does not know these tastes. We cannot even know that other people taste sugar or anything else just as we do.

Sugar is really a name for a closely related group of chemical substances all of which are sweet-tasting, though some are less so than others—for instance, milk sugar. But saccharin, which some people use instead of sugar, is utterly different from sugar chemically, yet it is sweeter than any sugar.

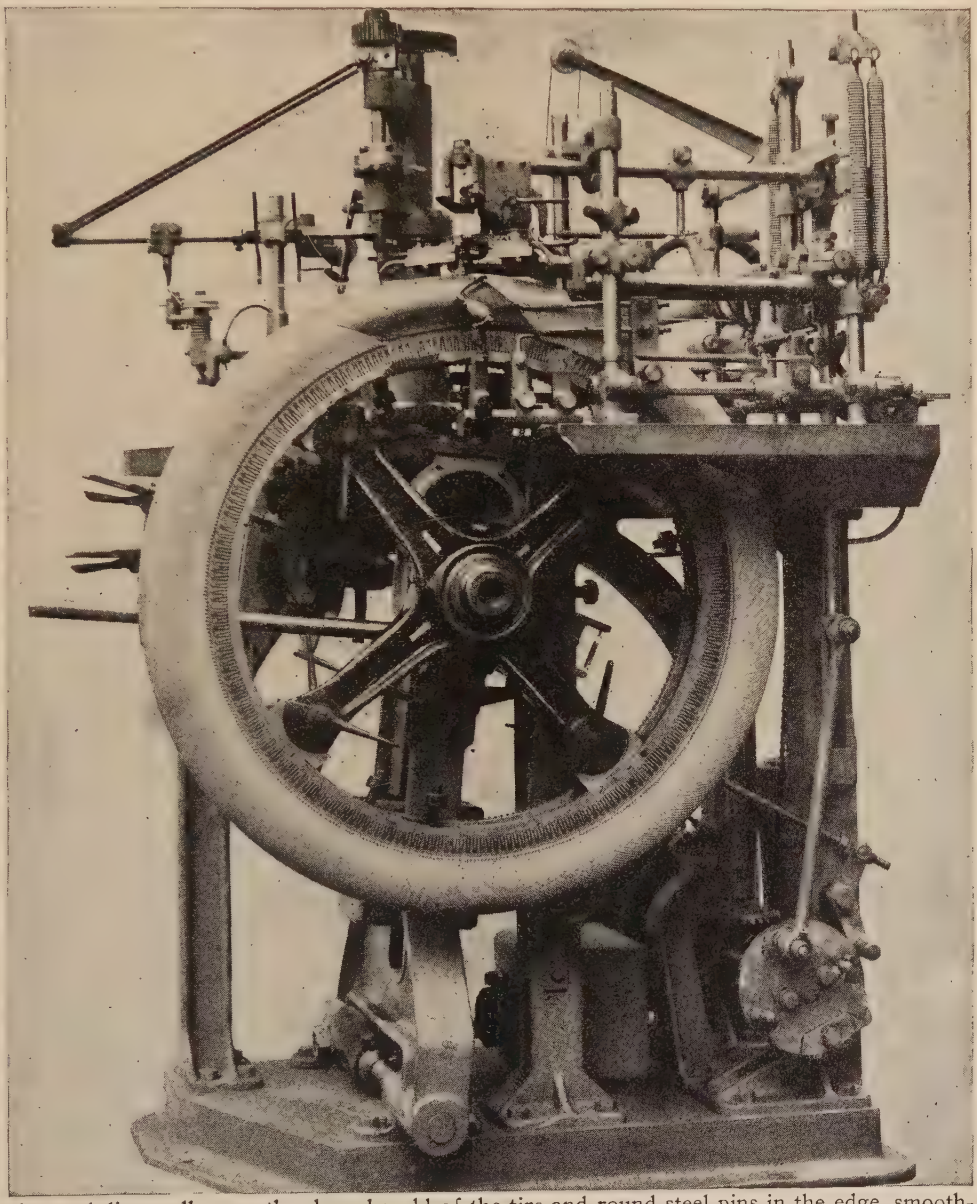
IS IT HARMFUL TO US TO DRINK RAIN-WATER?

All the water we drink is rain-water. Some of it has penetrated deeply into the earth and been drawn up from wells. Some has run down hillsides. Some has gone directly into reservoirs. But all drinking water has at one time been rain-water. The difference between rain-water directly collected in rain-tanks, or cisterns, and rain-water from springs and rivers and wells is mainly a difference of mineral salts in solution. Rain-water directly collected contains almost no mineral salts, while rain that has been in contact with earth and rocks contains mineral salts in greater or less abundance.

Therefore the answer is that it is not harmful to drink rain-water, though water containing a small amount of mineral salts is probably more wholesome and certainly more pleasant to drink.

HOW A MOTOR TIRE IS MADE

The outer cover of a motor tire is not usually of solid rubber, but is built up of layers of rubber and canvas, to give it strength to withstand the pressure of the air inside the tube, and the wear and tear of the roads. This is not the best way of covering a motor tire, however, and many covers are now being built up on cord foundations. The picture shows a wonderful machine used in making a famous cord tire. The foundation is of cotton cords, twisted from six strands, each strand being made of six threads, the whole impregnated with rubber. The machine lays



the cord diagonally over the shaped mold of the tire and round steel pins in the edge, smoothing and locking the cord and fingering it into position by means of two long claws. Another layer of cord is laid over this the opposite way, and the two layers thus looped over the steel pins in the beaded edge of the tire form its foundation. The cords are flattened so as slightly to overlap at the tread, and are separated from each other by a coating of rubber, so that they shall not rub each other and fray. The cord, beads and tread are now vulcanized and become so solid that the tire strongly resists thorns, flints, nails and damp.

DOES THE AIR EVER GET USED UP?

We may say that, in a sense, a great deal of the air has already been used up; for we know that by far the greater part of all the surface of the earth, including all the water of the seas, is already burned, and so has used up a great deal of the oxygen of the air. That happened a long time ago, however, before there were any living creatures on the earth.

The air is constantly being used now—or, rather, the oxygen of it is being used—in the breathing of all living creatures; while the nitrogen of the air is being used by certain microbes, and now also by men themselves, who use electricity for this purpose; and, thirdly, green plants use the carbon dioxid of the air, upon which they feed.

Yet the air does not get used up as regards any of these gases. There must be a compensation of some kind going on, and there is. There is a compensation, as regards the oxygen, because green plants everywhere in the sunlight are giving off to the air a great deal of oxygen—perhaps enough to make up for what they take in by breathing, and probably enough to make up for what animals and men take in by breathing.

As for the nitrogen that is used, we can easily show that that is compensated for; for when the animals and plants die, their bodies are decomposed, and most of the nitrogen they contain, which they originally got from the air, is given back to the air. Lastly, the carbon dioxid taken from the air by plants is compensated for by the carbon dioxid which all living creatures give out to the air when they breathe.

DOES THE SUN MOVE OR DOES IT STAND STILL?

Indeed, everything is always moving in one way or another. Galileo was imprisoned and silenced for saying that the earth moves, and now every child knows that it does. Once men thought that the sun remained perfectly still while the planets and their moons moved round it. But we have learned that that is not true. The sun has two movements. Like the earth, the sun spins, or rotates, upon itself, and in the same direction as the earth. Thus, we can notice a sun-spot appear at one side of the sun, travel across its face, disappear for several days, and then reappear where we saw it first.

But besides this movement of rotation, the sun has a movement of translation, as it is called—that is, an actual bodily movement from place to place. We do not doubt that all other stars are in motion too. It used to be impossible to see any sort of arrangement or order in the movements of the sun and the other stars; but now a German astronomer, Professor Kapteyn, and others following him seem to have shown that the stars consist of two great hosts which are streaming through or past each other in opposite directions and at different speeds, and they think that our sun belongs to one of these groups of stars. Of course, where the sun moves he carries all his family with him—planets, moons, comets, and so on, together with everything that is born and borne upon them; but neither astronomer nor other scientist can say where the sun is carrying us nor what the result will some day be.

DO WE SEE A THING AS SOON AS WE LOOK AT IT?

Certainly not. Seeing, like every other kind of sensation, takes time. From the instant that the light strikes the curtain at the back of our eyes to the instant that *we see* is quite a long time compared with some things—for instance, compared with the time it takes light to travel a mile.

We are likely to think a second the shortest part of time that is worth mentioning, but that is absurd. A second is a period of time so long that light, radiant heat, and electricity could travel almost as far as the moon in such a time. We must have another measure.

The wonderful thing about seeing is that it takes such a small fraction of a second for all the things to happen which are necessary before we can see. Complicated chemical changes have to take place in the living cells of the curtain at the back of the eye. These changes have to produce special nerve-currents, which in some amazing way correspond exactly to them; and these run along the eye-nerves, first to a group of cells in the lower part of the brain, and then from them, along another set of nerves, to the real eyes—a group of nerve-cells at the very back of the brain, which themselves have developed, and have always lived, in utter darkness. Something happens in them, and then we say *we see*. The marvel is that only a few hundredths of a second are needed for so much to happen.

HOW IS A MOTOR TIRE TESTED?

Motor-tire manufacturers find out the strength and wearing qualities of tires by long and exhaustive road-tests. Tires are fitted on light and heavy cars, ranging from about 10 up to 80 horse-power, and driven at varying speeds over good and bad roads. This is a practical way of discovering the worth and weaknesses of tires; but manufacturers have also a way of securing almost the same information in the laboratory without going to all the expense of road-tests.

The device they use consists, broadly speaking, of an electric motor arranged to drive a steel wheel on which can be mounted a rim and a tire. The tire on this rim is made to come in contact with another steel wheel, and the pressure between the two can be adjusted to equal the load that would be actually on the car. The wheel bearing the tire is revolved against the steel-surfaced wheel at any speed desired, and such speed is often far in excess of what would be reached by the car on the road.

Recording-instruments register the power absorbed in rotating the apparatus, the heat generated in the tires when revolving, and show whether the roundness and trueness of the tire are maintained. These machines are sometimes run night and day until the tires are worn out, so the manufacturer can get a clear idea of the strength of the tire.

ARE THE CLOUDS PART OF THE EARTH, AND DO THEY GO ROUND WITH IT?

Certainly the clouds are part of the earth. We sometimes forget that we do not really live on the outside of the earth at all, but only at the bottom of its outside layer, which we call the air or, in technical language, the atmosphere. That outside layer, and all it contains, such as the clouds, is as much part of the earth as the mountains or the oceans are. It is true that, from our point of view, we may think of the air as something laid on outside us to serve as a parasol by day and a blanket by night, as it does; but then our point of view depends only on where we happen to be, and we must not go by that.

The clouds are part of the earth and go round with it, as does the atmosphere in which the clouds hang. No doubt it is true that, as the earth spins, the air rather tends to drag behind; and high clouds will do this also. But, in general, the air and the clouds certainly spin round with the earth. If this were not so, there would be a gale so tremendous that we could not live at all.

WILL THE WORLD BECOME LIKE THE MOON?

Our earth will probably become like the moon. There will be certain differences, because the earth is much larger than the moon. The moon has been too small to hold to itself the gases outside it. It has no air, or atmosphere. The earth is able to keep its atmosphere because it is bigger, and so the power of its attraction is much greater. Besides the earth makes some heat of itself.

Another difference is that, in consequence of the rapid cooling of the moon, the changes on its surface have been more violent than those on the earth. The biggest volcano on the earth is as nothing compared with the moon's. But all these points of difference do not affect the fact that our earth is likely some day, though after a far longer time than men lately thought, to become cold and lifeless.

WHY DOES IRON BEND WHEN IT IS HOT?

We all know that things vary in the way they behave when something tries to alter their shape. Some things will rather break than bend; others will bend and then come back again to their old shape; yet others after bending will stay in the new shape. Various names are applied to these different properties of matter. A general rule that applies almost always is that the colder a thing is, the more rigid it is. This applies even to the three great states of matter, solid, liquid and gaseous; for it is only in the coldest of these—which is the solid state—that things can have any rigidity at all, and, as a rule, the colder a solid thing is, the more rigid it becomes. We believe that when a thing is made hot, the molecules of it are thrown into a state of greater motion, and we know that they are farther apart, for the thing expands. But if the molecules are farther apart, and if they are moving about more violently, they cannot be holding on to each other so tightly and rigidly as before, and so the thing which, when it was cold, could not be bent, can now be bent. Directly we understand the nature of heat, we see how reasonable it is that iron should behave as it does.

THE NEXT WONDER QUESTIONS ARE ON PAGE 455.

MEMBERS OF THE GREAT BAT FAMILY

The Great Bat—or Noctule Bat.

The African False Vampire.

Noctule Bats as they sleep.

Long-eared Bat.

Natterer's Bat.

Greater Horseshoe Bat.

Malay Fox Bat.

The Hairy-armed Bat.

The Abyssinian Epauletted Bat.

The photographs on these pages are by Messrs. Douglas English, J. J. Ward and C. W. R. Knight.

BATS AND THEIR FRIENDS

CONTINUED FROM 214

SHAKESPEARE'S song, sweet and melodious on the lips of his happy Ariel, is like an allegory. Insect, flower, bird and mammal are all named in turn, with the poor bat as the dainty sprite's own courser.

> Where the bee sucks, there suck I:
> In a cowslip's bell I lie;
> There I couch when owls do cry.
> On the bat's back I do fly
> After summer merrily.

Four great orders of created wonder march to the music of that verse, and it is wonderful to think of the ages nature must have taken to fashion the picture Shakespeare gives us in a flash. Repeatedly nature has given a long, slow turn to her kaleidoscope, and many an age elapsed before the outline of bee and cowslip, bat and owl, was perfected.

The bats did not come singly. They seem akin to reptile forms, and they and their kindred are among the oldest mammals. The mammal has warm blood and is hairy. A multitude of such mammals appeared, little timorous, insect-eating creatures. They endured, but not all by following the same line.

Many were driven by fear for their lives to hide in the earth, but the bats did a thing like magic. Some think they must have followed their prey about the rocks and have had many a tumble; they pursued them into the trees and flopped from branch to branch, and to the ground, spreading out arms and legs to break the shock of their fall. Many never got beyond the parachute stage.

What that was like we perhaps may see in many animals which glide through the air but do not fly. The so-called flying-lemur, the cobego, is the best example of the type. It is related to the bats and the other insect-eaters, but instead of wings it has flexible folds of skin, one on each side, from the throat to the hind quarters, and this natural parachute, expanding at the will of the animal, carries it through the air in a downward direction two hundred feet and more. But that is no more flight than the air-trips of the flying-fish.

Something better was needed. The birds showed feathers and flight; the reptiles sailed with their scaly leather-like wings up in the clouds, and still other forms appeared. Then came this line of insect-eaters which we see in the bats, animals which had real wings of flesh and blood and bone, without scales, without feathers. An entirely novel and marvelous creation seems to have appeared and was to become the ancestors of all the bats, whether they eat insects or fruit, or draw blood. Consider this natural wonder, this

little winged mammal, which has no free arms and legs, but has, instead, a living webbing, and flies superbly.

If you could take away the webbing, you would see a little animal with two arms and hands and two hind legs. But, though it has the same number of fingers as we have, they are strangely formed. The thumb is very short, and, instead of a nail, has a claw, or hook, which is used when the bat is not flying, to enable it to walk or to hang itself to anything upon which it means to rest when it folds its wings to go to sleep.

THE LITTLE ANIMAL WITH THE VERY LONG WINGS

The bones of the palms of the hand are not short and like ours, but very long, and joined to them are the finger-bones, which again are very long. This great length of bone is to support the web of the wings. The web stretches from the shoulders down the two bones of the arm over the bones of the hand, and down the tips of the four fingers. Then, from the under-side of the arms, it reaches down to the legs, as far as what would be our ankles, and between the legs to join on to the tail.

Thus the spread of the wings is very big for the size of the bat. The biggest bat in this country is less than six inches all told, yet its wings, when spread out, measure fifteen inches from tip to tip.

There is no other common animal that we know less of than the bat. The reason is that it comes out only at night. Its eyes are so formed that it must sleep when the sun is shining, but at night it can see splendidly. It lives entirely on insects, and by eating these does good work for man. We cannot see the insects it catches, but the insects are in the air all the same; and if the bats did not catch them they would be a great nuisance to us.

THE BAT'S AMAZING SENSE OF FEELING WITHOUT TOUCH

There is something about the bat which none of us can understand. Added to its good sight, it has the most wonderful power of feeling its way through the air. There is a great network of nerves and veins all over its wings, and there are clusters of nerves about its nose which act as a sort of telegraph to control the wings as the little animal flies about in the dusk. A man who gave his life to the study of animals once tested bats in a strange way. He got some bats whose sense of sight and smell and hearing had gone from them. He turned them loose in a room in which were many corners and obstacles against which they were likely to dash themselves. They flew without fear about the room, and never came in contact with anything that might hurt them. Then the man strung many threads across the room, but the bats flew between them as easily as if nothing were there. When the man placed his hand in the way of their flying, though they could neither hear, see nor smell, they avoided it without difficulty.

Bats are like birds in this, that their blood is very hot, but there is a strange difference. The bird dies if it cannot keep warm. The bat, however, goes to sleep in winter. Its sleep is so like death that you would think the bat in its winter sleep dead. It almost ceases to breathe, and its body, so warm in summer, is in winter almost quite cold.

THE GIANT BATS OF THE EAST THAT LIVE ON FRUIT

Most of the bats of the United States and Canada eat only insects, but there are a few fruit-eating bats in the extreme south of the United States and many in Mexico and Central America. Some of the foreign bats do much damage to crops in Japan, Australia, the Pacific Islands, India, Ceylon, Madagascar and South America. The biggest of these measures nearly five feet across the wings. It is called the flying-fox because it has red-brown fur and a head something like a fox. In some parts of the Old World the natives must tie up their growing fruit in baskets to save it from these bats.

Stories of bats which suck the blood of animals, even of men, have long been told, but they were seldom caught in the act. Harmless fruit-eating bats were by mistake given the dreadful name of vampire. The real bloodsuckers are small bats, three inches or less in length. One, the *desmodus*, lives in Central and South America, and the other is found only in Brazil. They get blood from horses and cattle, and do great harm to poultry. It used to be supposed that a great vampire could kill a human being, but the so-called vampires do not suck blood, and the little *desmodus* cannot take enough at one time to do much harm, but sometimes the bites cause sores.

There is nothing more startling than

QUEER LITTLE INSECT-EATERS

Common Shrew.

Long-nosed Jumping-shrew.

Pigmy Shrew.

Mole.

Water-shrew.

Quaint-looking Solenodon of Cuba.

The Tenrec that roams by night.

The Hedgehog has a drink.

the operation of such a bat. It performs its surgery at dead of night in a darkened room, and, while drawing its meal, supports itself in the air by the beating of its wings. We marvel at the kestrel as she hangs with rapidly moving wings in the air, at the humming-bird poised at the gateway of a flower; but this winged mammal, stealthily sucking blood while balancing like a living airship, is more wonderful than either.

A HARMFUL ANIMAL THAT WILL HAVE TO PERISH

That leads us to this conclusion. The bloodsucking bat will have to go. It cannot alter. Unlike the rest of the bats and insect-eaters, it has no grinding teeth, and it is so accustomed by ages of habit to a diet of blood that its throat and stomach have grown too small for anything but fluid. Yes, these bats which have this hateful way of gaining a living must go, and so must the flying-foxes, which live near plantations and ruin the fruit of men's labors. So destructive are they in the fruit-growing areas of Australia that flame-throwers, like those used in the World War, have been used in Queensland to destroy them.

But with the exception of certain fruit bats and the bloodsuckers all the bats are helpful allies of man. The bats of the United States and Canada do a great deal of good by catching millions of mosquitoes and other annoying or harmful insects. There are many varieties. The most common are the brown bats, little and big, the silver-haired, the red, the hoary, and the pipistrelles.

THE MODEST, HARMLESS AND QUEER LITTLE BATS

They haunt belfries, barns, old sheds, trees, clefts and crannies, anywhere and everywhere, and issue at night to hunt and munch as they fly. We have few of the fantastic forms, which have appendages to their noses like leaves and blossoms. Ours are modest and unassuming, contrasted with foreign bats. Ceylon has, in the *Kerivoula picta,* bats which are so brilliantly colored as to look like butterflies. There are two South American bats which catch and eat small fish. Some bats are white, and a Malayan bat is naked but for a fringe of hairs round the neck.

Bats are devoted mothers, and carry their young with them clinging to their fur, but the naked bat, having no fur for baby bats to cling to, has a living cradle. This is a deep, fleshy pouch on the underside of the body in which the thriving infant is carried. With that in mind, and the further strange fact that some bats have sucker-disks, like the implements of the octopus, to their thumbs and feet, so enabling them to climb the smoothest surfaces, we must bid adieu to the wing-handed folk—one of the most fantastic, astonishing and successful of all nature's experiments.

What that same wizard nature can do we shall now see as we turn to the great assembly of animals called the Insectivora, which means "insect-eaters." They have that name because the peculiar character of their pointed teeth enables them to penetrate the horny cases in which many of their victims are sheathed.

THE WINGLESS LONG-NOSED ANIMALS OF THE ORDER

They are all long-snouted, they all have furry coats, and the majority of them are creatures of the night and the underworld. But note the exceptions. The hedgehog has converted part of his hairy covering into spines, and can roll himself up like a ball. Some, like the tupaias, have taken to the trees, and many forms have adapted themselves to life chiefly spent in the water. The variety in habit and structure is immense.

These animals are not very highly developed, but they are widely spread throughout the world, except in Australia, where there are none. In South America there are only a few shrews, but the rocks show that many years ago a little animal very much like the golden mole now living in Africa existed there. Perhaps South America and Africa were once united by a land bridge.

The rocks tell other interesting stories. Now the hedgehog is found only in the Old World, but in the Dakota deposits scientists have found the remains of a species of hedgehog which existed many years ago. They think that this is a little piece of evidence to show that North America and Asia were once joined together, so that animals could pass from one continent to the other.

The animals are generally stupid. Their brains are small and smooth, and they are tiny in size, but, nevertheless, they have performed and do still perform valuable work.

And we are glad that it is so. The in-

sectivores owe almost nothing to man, but man owes half his fortune and more to the insectivores. It is always a close fight between man and insect, always a chance that the insect may win. If by some unhappy chance we should have to do without the aid of the Insectivora, our crops and harvests, the things we grow for food, it is full of wonders. In fact, the mole seems to be going backward. It uses its eyes no more than the penguin uses its wings. Indeed, its cousin, the golden mole, is now absolutely without sight.

We have noted the progressive weakness of the common mole's sight, so must see what he gains by his sacrifice. Prob-

FLYING-FOXES AT REST IN A TREE

medicine and clothes, would fall before the millions of tiny foes. They would starve us by eating all herbage off the face of the earth. The Insectivora are our dull, stupid guardians against that dreadful misfortune; so let us rejoice that they continue to exist.

Our common mole is an exceedingly primitive animal. Its body shows plainly that it is not highly developed, but still ably it is increasing engineering skill. Next to the worm he has done more than anything to plow the world's soil. He is a superb tunneler, a master engineer who constructs beautiful galleries leading to a marvelous hall or fortress, with an almost equally elaborate nursery for the little ones.

Perhaps the stories of his great skill, which are sometimes printed, have been

exaggerated, but critics go to the opposite extreme in suggesting that many of the galleries have been made without any purpose. They forget that the mole, which is a voracious feeder, is constantly burrowing for worms and larvæ, and sinking wells for water. Hence tunnels and descents are by no means useless.

Damage may be done here and there to lawns and flower-borders by moles, but the balance in the little sable gentleman's favor is enormous. To estimate his night's labor we have to imagine a man excavating, between sunset and sunrise, a tunnel thirty-seven miles long!

Far and near the mole and its allied forms roam. The desman is of the family tree, long-muzzled, flat-tailed, a superb swimmer, whose webbed feet dig tunnels twenty feet deep in the banks of Asian streams where leeches and water insects afford it ample diet. There is a web-footed mole in North America which lives far inland. The waters which called for the special faculty for swimming have left the mole, or the mole has left them, but the webs on the feet proclaim the past.

THE USEFUL SHREW, AND HOW HE HAS DAMAGED HIS CHARACTER

Next in order comes the hedgehog, born blind, with prickles soft and white as cotton, and squeaking when its mother is long absent, like a baby pig. Hedgehogs are stupid things, content with their magnificent armor and the security of night-hunts and hidden beds for day and winter.

Once there were near relatives of the hedgehogs in Europe, but now we must go to Asia for them and find them in ratlike creatures called the gymnuras. Although ratlike in appearance, the gymnura, stripped of his jacket, is like a hedgehog in his bones, but he cannot convert himself into a ball as his tiny cousin does.

The shrew is often called a destructive mouse, but he is a priceless aid as an insect-eater. He is the victim of an age-long superstition which attributes to him poison, paralysis and pestilence to man and beast. His only offense is against the nose, for he has a strong, disagreeable odor. In that he is not exceptional, for this defense is common to many shrews, of which the world has no fewer than one hundred and twenty species.

It is, numerically, a rich assemblage. The tupaias, or tree-shrews, are kings of the greenwood tree, wonderfully like squirrels, in spite of their long, flexible snouts. This feature, however, finds its most extravagant development in the shrews, whose trunklike nose gives them the name of elephant shrews. Yet they are as agile as crickets, leaping, by means of their abnormally long hind legs, as if they had once tried to be little kangaroos. Some of them are the smallest of the mammals we know.

THE FINE WORK DONE BY THE LOWLY ORDER OF INSECT-EATERS

As bats have a fish-eater, so have the shrews, in a wonderful creature called the otter-shrew, a name which carries its own story of the apparent lines of progress followed by this species. Yet perhaps the web-footed shrew is even more notable for a novel method of mastering fate. Not only is it web-footed, it has produced extraordinary little sucker-pads on its feet for an unparalleled purpose—so that in seeking its food at the bottom of the water it may cling to stones and other smooth faces and not be carried up against its will by buoyancy, unfed.

We should like that type in our ponds, but we do not envy our Indian friends their musk-shrew whose odor makes uneatable anything it touches; and we do not covet the king of the order, the Madagascar tenrec, tailless, sixteen inches long, with spines hidden in his hair, and a ferocious bite. Tenrecs might become too numerous: the female of one species has as many as twenty-one infant tenrecs at a birth. Fortunately, these animals are generally insectivorous, and the solenodon, a dismal ratlike creature with alarming claws, is devoted to similar good work.

THE MANY SHREWS OF NORTH AMERICA

Though there are many varieties of shrews in North America, no animals are so little known, because of their small size and their quick motions. The short-tailed shrews are very much like moles in appearance. The smaller long-tailed shrews are more like mice. They search everywhere, among leaves, under logs, in hollow trees, for beetles or crickets. The marsh-shrew is longer. It lives along streams or ponds, and often dives for minnows or water-beetles. All have enormous appetites, and easily eat much more than their weight in a single day.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 353.

THE POEMS OF LONG AGO

THERE were poets in ancient Egypt thousands of years before Jesus was born. In Babylonia and Assyria there were poets, too, thousands of years ago. But the study of poetry does not take account of these very ancient times. The finest poetry of Greece was composed more than two thousand years ago, and is read and studied to this day in all parts of the world. We are not going back here so far even as that. "Long ago" may mean thousands or hundreds of years. If we think of English poetry only, it cannot mean quite a thousand years, for the English language is not so old as that; and it is English poetry we are learning here.

THE EARLIEST ENGLISH POETRY

CONTINUED FROM 228

THERE were many kinds of poets and poetry before the beginning of English poetry, but Geoffrey Chaucer, who died in the year 1400, is called the "father" of English poetry because his was the first really fine poetry to be written in the English language of his day—very different from ours. We have heard about the bards who in olden times sang songs of victory after battles, or perhaps sang mournful dirges of death and defeat. Their poetry was never written, of course; but people had wonderful memories in those far-off days before the art of writing was known to them, and songs of the old bards were remembered for hundreds of years and written down in later ages, and still later put into modern words and printed.

The early bards in the British Isles were Celts, a different people from the mixed Teutonic race known as English, coming later. There are still many people descended from the Celts in Wales, in the Scottish Highlands and in Ireland. They had two languages, Gaelic and Cymric; and both are still spoken, but they are not a bit like English. So, you see, the old Celtic poetry of the British Isles is not English poetry at all. This old Celtic poetry was full of fire and vigor and love of fighting.

The coming of Christianity into England had a great effect on men's minds, and one of the earliest poets, named Cædmon, who was a cowherd, and lived in Yorkshire, where he died about the year 680, wrote good poetry to make people rejoice in the Bible and its teaching. But Cædmon's verses, and those of the English poets for several hundred years afterward, were not in the least like modern poetry. They had no regular movement of what we call rhythm, which means the varying time of the words that make them like music in the mind as we read. They had no rhymes, no regular length of lines, but just sought to express the thought or vision in the poet's mind as quickly and clearly as possible. These very early poems, however, had what we call "alliteration," which means words beginning with the same letter.

In every line two or more words began with the same letter and marked a point of accent, which helped one to remember the words. Alliteration has often been used by poets, and a celebrated writer spoke of "*a*pt *a*lliteration's *ar*tful *a*id." Here is a line from Milton showing its proper use:

Of man's *f*irst disobedience and the *f*ruit
of that *f*orbidden tree.

Examples from the early English poets would not be understood, but it is interesting to know that their idea of how poetry should be written was simply to use words at certain intervals beginning with the same letters.

About the end of the twelfth century poets began to use accent and rhyme, and thus a definite break with the old Anglo-Saxon poetry occurred. Chaucer used both rhyme and accent. Wyatt and Surrey, in the early sixteenth century, introduced poetical forms from abroad, and Spenser later used every variety of form of English verse.

HOME, SWEET HOME

Story-tellers often invent sad tales, but, after all, no tales are so sad or strange as those of real life. Wherever the English language is spoken, the famous song of Home, Sweet Home has been sung for over eighty years. It is, perhaps, the favorite song in our language, expressing, as it does, the love of home the world over. Yet it was written by an American named John Howard Payne, who never knew what it was to have a home. He was born in 1792, and died in Tunis in 1852, after a strange career. For a short time he was a popular actor in London, and wrote a very successful opera in 1823, called Clari; or the Maid of Milan, in which this beautiful song was first sung. But most of his life was a failure, and he even was a wanderer without a lodging for a time after he had written his immortal song. One cold winter's night, when he was homeless in New York, he heard it being sung in a cozy house as he was passing by. And he died in Africa "an exile from home."

'MID pleasures and palaces though we may roam,
Be it ever so humble, there's no place like home!
A charm from the skies seems to hallow us there,
Which, seek through the world, is ne'er met with elsewhere.

Home, home, sweet, sweet home!
There's no place like home!

An exile from home, splendour dazzles in vain!
Oh, give me my lowly thatched cottage again!
The birds singing gaily that came at my call—
Give me them!—and the peace of mind, dearer than all!

Home, home, sweet, sweet home!
There's no place like home!

THE SANDS OF DEE

Charles Kingsley, who wrote this fine ballad, was a master of this form of poetry. How much he can tell in so little space! Notice how the weird picture of the cruel sea that drowned poor Mary is brought before our mind's eye by the repetition of certain words in the first three lines of the second and fourth verses. It is a legend that the voice of the drowned maiden can be heard still calling the cattle home. This, of course, is one of those fancies that come to our minds in listening to the strange noises of the sea.

"O MARY, go and call the cattle home,
And call the cattle home,
And call the cattle home,
Across the sands of Dee."
The western wind was wild and dank with foam,
And all alone went she.

The western tide crept up along the sand,
And o'er and o'er the sand,
And round and round the sand,
As far as eye could see.
The rolling mist came down and hid the land
And never home came she.

"Oh! is it weed, or fish, or floating hair—
A tress of golden hair,
A drownèd maiden's hair
Above the nets at sea?"
Was never salmon yet that shone so fair
Among the stakes on Dee.

They rowed her in across the rolling foam,
The cruel, crawling foam,
The cruel, hungry foam,
To her grave beside the sea.
But still the boatmen hear her call the cattle home
Across the sands of Dee.

SWEET AND LOW

A lullaby is a baby song that can be sung to the rocking of the cradle, and ought to have in it something of the music of the "rock-a-bye" movement of the cradle. How full of this gentle and soothing music is this beautiful cradle-song by Lord Tennyson, the great English poet! It is a perfect gem of simple beauty.

SWEET and low, sweet and low,
Wind of the western sea,
Low, low, breathe and blow,
Wind of the western sea!
Over the rolling waters go,
Come from the dying moon and blow,
Blow him again to me;
While my little one, while my pretty one, sleeps.

Sleep and rest, sleep and rest,
Father will come to thee soon;
Rest, rest, on mother's breast,
Father will come to thee soon;
Father will come to his babe in the nest,
Silver sails all out of the west
Under the silver moon:
Sleep, my little one, sleep, my pretty one, sleep.

BOADICEA

We know what an ode is, having read about it on page 223. This is a fine poem of that class, written by William Cowper, one of the great English poets, who died in the year 1800. It is a song in praise of Boadicea, the patriot queen who roused the people of Britain in revolt against their Roman oppressors. At first she was victorious, but later was defeated by the veteran soldiers of Rome. She died in the year 62. See page 1321 for Boadicea in her war chariot. What we have learned about the old bards of Celtic England is now very useful in helping us to understand this poem.

WHEN the British warrior queen,
Bleeding from the Roman rods,
Sought, with an indignant mien,
Counsel of her country's gods,

Sage beneath the spreading oak
Sat the Druid, hoary chief;
Every burning word he spoke
Full of rage, and full of grief.

Princess! if our aged eyes
Weep upon thy matchless wrongs,
'Tis because resentment ties
All the terrors of our tongues.

Rome shall perish—write that word
In the blood that she has spilt;
Perish, hopeless and abhorr'd,
Deep in ruin as in guilt.

Rome, for empire far renown'd,
Tramples on a thousand states;
Soon her pride shall kiss the ground—
Hark! the Gaul is at her gates!

Other Romans shall arise,
Heedless of a soldier's name;
Sounds, not arms, shall win the prize,
Harmony the path to fame.

Then the progeny that springs
From the forests of our land,
Arm'd with thunder, clad with wings,
Shall a wider world command.

Regions Cæsar never knew
Thy posterity shall sway;
Where his eagles never flew,
None invincible as they.

Such the bard's prophetic words,
Pregnant with celestial fire,
Bending as he swept the chords
Of his sweet but awful lyre.

She, with all a monarch's pride,
Felt them in her bosom glow;
Rush'd to battle, fought, and died;
Dying hurl'd them at the foe;

Ruffians, pitiless and proud,
Heaven awards the vengeance due;
Empire is on us bestow'd,
Shame and ruin wait on you.

ALL THINGS SHALL PASS AWAY

This poem was written by an American poet named Theodore Tilton. If you read it carefully you will find that it is written with great skill and effect. For the poet begins by making us feel, with the Persian king, how vain are the pleasures and beauties of this world, since Death will claim them all; but at the end he restores us to hope by reminding us that Death itself will pass away, and the new life beyond this life of ours will then begin.

ONCE in Persia ruled a King,
Who upon his signet ring
'Graved a motto true and wise,
Which, when held before his eyes,
Gave him counsel at a glance
Fit for any change or chance.
Solemn words, and these were they:
"Even this shall pass away."

Trains of camel through the sand
Brought him gems from Samarcand;
Fleets of galleys through the seas
Brought him pearls to rival these.
Yet he counted little gain
Treasures of the mine or main.
"Wealth may come, but not to stay;
Even this shall pass away."

'Mid the revels of his court,
In the zenith of his sport,
When the palms of all his guests
Burned with clapping at his jests,
He, amid his figs and wine,
Cried: "Oh, precious friends of mine,
Pleasures come, but not to stay—
Even this shall pass away."

. . . . . .

Fighting in a furious field,
Once a javelin pierced his shield,
Soldiers with a loud lament
Bore him bleeding to his tent.
Groaning from his wounded side,
"Pain is hard to bear!" he cried.
"But with patience, day by day,
Even this shall pass away."

Towering in the public square,
Twenty cubits in the air,
Rose his statue grand in stone;
And the King, disguised, unknown,
Gazing on his sculptured name,
Asked himself: "And what is fame?
Fame is but a slow decay—
Even this shall pass away."

Struck with palsy, sere and old,
Standing at the gates of gold,
Spoke he thus in dying breath:
"Life is done, and what is death?"
Then, in answer to the King,
Fell a sunbeam on the ring,
Answering, with its heavenly ray:
"Even death shall pass away."

BUTTERCUPS AND DAISIES

There are other poems by Mary Howitt elsewhere, and one of them, The Spider and the Fly, we all know. Mary Howitt was married to an author, William Howitt. The two often worked together and published in all over a hundred and fifty books. We remember them for their efforts to provide wholesome literature. The Howitts lived much abroad, in Germany, Italy and Switzerland.

BUTTERCUPS and daisies,
Oh, the pretty flowers;
Coming ere the spring time,
To tell of sunny hours,
While the trees are leafless,
While the fields are bare,
Buttercups and daisies
Spring up here and there.

Ere the snow-drop peepeth,
Ere the crocus bold,
Ere the early primrose
Opes its paly gold,—
Somewhere on the sunny bank
Buttercups are bright;
Somewhere midst the frozen grass
Peeps the daisy white.

Little hardy flowers,
Like to children poor,
Playing in their sturdy health
By their mother's door.
Purple with the north-wind,
Yet alert and bold;
Fearing not, and caring not,
Though they be a-cold!

What to them is winter!
What are stormy showers!
Buttercups and daisies
Are these human flowers!
He who gave them hardships
And a life of care,
Gave them likewise hardy strength
And patient hearts to bear.

THE PULLEY

In this beautiful poem George Herbert tries quaintly to explain why man having so much is yet discontented and weary. Endowed with strength and beauty, wisdom and honor, he is in danger of forgetting whence came these gifts. So God holds back the gift of rest in order that "If goodness lead him not, yet weariness may toss him to My breast."

WHEN God at first made Man,
Having a glass of blessings standing by—
Let us (said He) pour on him all we can;
Let the world's riches, which dispersèd lie,
Contract into a span.

So strength first made a way,
Then beauty flowed, then wisdom, honor, pleasure:
When almost all was out, God made a stay,
Perceiving that, alone of all His treasure,
Rest in the bottom lay.

For if I should (said He)
Bestow this jewel also on My creature,
He would adore My gifts instead of Me,
And rest in Nature, not the God of Nature:
So both should losers be.

Yet let him keep the rest,
But keep them with repining restlessness;
Let him be rich and weary, that at least,
If goodness lead him not, yet weariness
May toss him to My breast.

ANSWER TO A CHILD'S QUESTION

Here again we have a great poet, who has thrilled many men and women with his powerful verse, writing the simplest strains for boys and girls. Samuel Taylor Coleridge, author of that wonderful poem The Ancient Mariner, is the writer of these lines, which tell us in sweet, simple language that the song of birds is a song of love and joy.

DO you know what the birds say? The sparrow, the dove,
The linnet and thrush say: "I love and I love!"
In the winter they're silent—the wind is so strong;
What it says I don't know, but it sings a loud song.
But green leaves, and blossoms, and sunny warm weather,
And singing, and loving—all come back together;
But the lark is so brimful of gladness and love,
The green fields below him, the blue sky above,
That he sings, and he sings, and for ever sings he—
"I love my love, and my love loves me!"

THE LOSS OF THE ROYAL GEORGE

This poem was written by William Cowper when the news arrived, in September, 1782, that the great warship the Royal George had foundered off Spithead on August 20th of that year. Richard Kempenfelt was a brave English admiral, although his ancestors were Swedish. There is the mournful music of a funeral knell in the verses, the whole poem being solemn and dignified.

TOLL for the brave!
The brave that are no more!
All sunk beneath the wave,
Fast by their native shore!

Eight hundred of the brave,
Whose courage well was tried,
Had made the vessel heel,
And laid her on her side.

A land breeze shook the shrouds,
And she was overset;
Down went the Royal George
With all her crew complete.

Toll for the brave!
Brave Kempenfelt is gone;
His last sea fight is fought,
His work of glory done.

It was not in the battle,
No tempest gave the shock;
She sprang no fatal leak,
She ran upon no rock.

His sword was in its sheath,
His fingers held the pen,
When Kempenfelt went down,
With twice four hundred men.

Weigh the vessel up,
Once dreaded by our foes!
And mingle with our cup
The tear that England owes.

Her timbers yet are sound,
And she may float again
Full charged with England's thunder,
And plough the distant main.

But Kempenfelt is gone,
His victories are o'er;
And he and his eight hundred
Shall plough the wave no more.

ROBIN REDBREAST

One thing always to remember about poetry is that it can express the feelings of the heart far better than prose. You will feel this when you read this beautiful poem about Robin Redbreast and the coming of winter, by William Allingham. How surely the poet expresses in warm and friendly words his love for dear Robin Redbreast! So much feeling could not be put into so few words but for the power of poetry.

GOOD-BYE, good-bye to summer!
For summer's nearly done;
The garden smiling faintly,
Cool breezes in the sun;
Our thrushes now are silent,
Our swallows flown away,—
But Robin's here, in coat of brown,
With ruddy breast-knot gay.
Robin, Robin Redbreast,
O Robin dear!
Robin singing sweetly
In the falling of the year.

Bright yellow, red, and orange,
The leaves come down in hosts;
The trees are Indian princes,
But soon they'll turn to ghosts;
The scanty pears and apples
Hang russet on the bough;
It's autumn, autumn, autumn late,
'Twill soon be winter now.
Robin, Robin Redbreast,
O Robin dear!
And welaway! my Robin, Robin,
For pinching days are near.

The fireside for the cricket,
The wheat-stack for the mouse,
When trembling night-winds whistle
And moan all round the house;
The frosty ways like iron,
The branches plumed with snow—
Alas! in winter, dead and dark,
Where can poor Robin go?
Robin, Robin Redbreast,
O Robin dear!
And a crumb of bread for Robin,
His little heart to cheer.

GOOD-NIGHT

These simple verses, which have often been sung by mothers to their children, were written by Jane Taylor.

BABY, baby, lay your head
On your pretty cradle bed;
Shut your eye-peeps, now the day
And the light are gone away;
All the clothes are tuck'd in tight;
Little baby, dear, good-night.

Yes, my darling, well I know
How the bitter wind doth blow;
And the winter's snow and rain
Patter on the window-pane;
But they cannot come in here
To my little baby dear.

For the window shutteth fast,
Till the stormy night is past,
And the curtains warm are spread
Round about her cradle bed;
So till morning shineth bright,
Little baby, dear, good-night.

LIFE IN A LOVE

Like most of Robert Browning's verse, the meaning of this poem is a little obscure, though perhaps it means no more than to do in love as one should do in life—"laugh at a fall, and, baffled, get up and begin again."

ESCAPE me?
Never—
Beloved!
While I am I, and you are you,
So long as the world contains us both,
Me the loving and you the loth,
While the one eludes, must the other pursue.
My life is a fault at last, I fear:
It seems too much like a fate, indeed!
Though I do my best I shall scarce succeed.
But what if I fail of my purpose here?
It is but to keep the nerves at strain,
To dry one's eyes and laugh at a fall,
And, baffled, get up and begin again,—
So the chase takes up one's life, that's all.
While, look but once from your farthest bound
At me so deep in the dust and dark,
No sooner the old hope drops to ground
Than a new one, straight to the self-same mark,
I shape me—
Ever
Removed!

ISRAFEL

Edgar Allan Poe wrote this poem on a line from the Koran, the sacred book of the Mohammedans, "And the angel Israfel, whose heart-strings are a lute, and who has the sweetest voice of all God's creatures."

IN Heaven a spirit doth dwell
Whose heart-strings are a lute;
None sing so wildly well
As the angel Israfel,
And the giddy stars (so legends tell),
Ceasing their hymns, attend the spell
Of his voice, all mute.

Tottering above
In her highest noon,
The enamoured moon
Blushes with love,
While, to listen, the red levin
(With the rapid Pleiads, even,
Which were seven)
Pauses in Heaven.

And they say (the starry choir
And the other listening things)
That Israfeli's fire
Is owing to that lyre
By which he sits and sings,
The trembling living wire
Of those unusual strings.

But the skies that angel trod,
Where deep thoughts are a duty,
Where Love's a grown-up God,
Where the Houri glances are
Imbued with all the beauty
Which we worship in a star.

Therefore thou art not wrong,
Israfeli, who despisest
An unimpassioned song;
To thee the laurels belong,
Best bard, because the wisest:
Merrily live, and long!

The ecstasies above
With thy burning measures suit:
Thy grief, thy joy, thy hate, thy love,
With the fervor of thy lute:
Well may the stars be mute!

Yes, Heaven is thine; but this
Is a world of sweets and sours;
Our flowers are merely—flowers,
And the shadow of thy perfect bliss
Is the sunshine of ours.

If I could dwell
Where Israfel
Hath dwelt, and he where I,
He might not sing so wildly well
A mortal melody,
While a bolder note than this might swell
From my lyre within the sky.

TO AUTUMN

Autumn fulfilling her function to "load and bless with fruit"; Autumn as she works in granary and by cider-press; Autumn as she sings through cricket and swallow—are pictures given us by John Keats in this lovely ode.

SEASON of mists and mellow fruitfulness!
Close bosom-friend of the maturing sun;
Conspiring with him how to load and bless
With fruit the vines that round the thatch-eaves run;
To bend with apples the mossed cottage-trees,
And fill all fruit with ripeness to the core;
To swell the gourd, and plump the hazel shells
With a sweet kernel; to set budding more,
And still more, later flowers for the bees,
Until they think warm days will never cease,
For Summer has o'erbrimmed their clammy cells.

Who hath not seen thee oft amid thy store?
Sometimes whoever seeks abroad may find
Thee sitting careless on a granary floor,
Thy hair soft-lifted by the winnowing wind;
Or on a half-reaped furrow sound asleep,
Drowsed with the fume of poppies, while thy hook
Spares the next swath and all its twinèd flowers;
And sometimes like a gleaner thou dost keep
Steady thy laden head across a brook;
Or by a cider-press, with patient look,
Thou watchest the last oozings, hours by hours.

Where are the songs of Spring? Ay, where are they?
Think not of them, thou hast thy music too,
While barrèd clouds bloom the soft-dying day
And touch the stubble-plains with rosy hue;
Then in a wailful choir the small gnats mourn
Among the river sallows, borne aloft
Or sinking as the light wind lives or dies;
And full-grown lambs loud bleat from hilly bourn;
Hedge-crickets sing, and now with treble soft
The redbreast whistles from a garden-croft,
And gathering swallows twitter in the skies.

ANNIE LAURIE

So tender that it moves one almost to tears is this well-known song by William Douglas. In every verse the repetition of the fourth line, the absolute devotion expressed by the last, and the exquisite comparisons of the first four lines combine to make one of the world's most beautiful love-songs. It is known everywhere.

MAXWELTON braes are bonnie
Where early fa's the dew,
And it's there that Annie Laurie
Gie'd me her promise true—
Gie'd me her promise true,
Which ne'er forgot will be;
And for bonnie Annie Laurie
I'd lay me doun and dee.

Her brow is like the snaw-drift;
Her throat is like the swan;
Her face it is the fairest
That e'er the sun shone on—
That e'er the sun shone on—
And dark blue is her ee;
And for bonnie Annie Laurie
I'd lay me doun and dee.

Like dew on the gowan lying
Is the fa' o' her fairy feet;
And like the winds in summer sighing,
Her voice is low and sweet—
Her voice is low and sweet—
And she's a' the world to me;
And for bonnie Annie Laurie
I'd lay me doun and dee.

"WOODMAN, SPARE THAT TREE"

A familiar, much-quoted poem, distinguished for its natural feeling. The oak, beautiful in itself, is doubly so for reason of its associations. Planted by the father, it sheltered the children. With the family scattered, it stands as a monument to its early beginnings.

WOODMAN, spare that tree!
Touch not a single bough!
In youth it sheltered me,
And I'll protect it now.
'Twas my forefather's hand
That placed it near his cot;
There, woodman, let it stand,
Thy axe shall harm it not!

That old familiar tree,
Whose glory and renown
Are spread o'er land and sea,—
And wouldst thou hew it down?
Woodman, forbear thy stroke!
Cut not its earth-bound ties;
O, spare that agèd oak,
Now towering to the skies!

When but an idle boy
I sought its grateful shade;
In all their gushing joy
Here, too, my sisters played.
My mother kissed me here;
My father pressed my hand—
Forgive this foolish tear,
But let that old oak stand!

My heart-strings round thee cling,
Close as thy bark, old friend!
Here shall the wild-bird sing,
And still thy branches bend.
Old tree! the storm still brave!
And, woodman, leave the spot;
While I've a hand to save,
Thy axe shall harm it not.

O SWALLOW, SWALLOW, FLYING SOUTH

This beautiful love-song comes from Tennyson's Princess. By it the Prince, disguised as a girl-student in the college of the Princess, strove to convey his love.

O SWALLOW, Swallow, flying, flying South,
Fly to her, and fall upon her gilded eaves,
And tell her, tell her what I tell to thee.
O, tell her, Swallow, thou that knowest each,
That bright and fierce and fickle is the South,
And dark and true and tender is the North.
O Swallow, Swallow, if I could follow, and light
Upon her lattice, I would pipe and trill,
And cheep and twitter twenty million loves.
O, were I thou that she might take me in,
And lay me on her bosom, and her heart
Would rock the snowy cradle till I died!
Why lingereth she to clothe her heart with love,
Delaying as the tender ash delays
To clothe herself, when all the woods are green?
O, tell her, Swallow, that thy brood is flown;
Say to her, I do but wanton in the South,
But in the North long since my nest is made.
O, tell her, brief is life but love is long,
And brief the sun of summer in the North,
And brief the moon of beauty in the South.
O Swallow, flying from the golden woods,
Fly to her, and pipe and woo her, and make her mine,
And tell her, tell her, that I follow thee.

KATHLEEN MAVOURNEEN

Louisa Macartney Crawford is the author of this touching song which pictures the lover early in the morning of his last day in Erin awaiting his mistress' coming.

KATHLEEN MAVOURNEEN! the gray dawn is breaking,
The horn of the hunter is heard on the hill;
The lark from her light wing the bright dew is shaking,—
Kathleen Mavourneen! what, slumbering still?
Oh, hast thou forgotten how soon we must sever?
Oh! hast thou forgotten this day we must part?
It may be for years, and it may be forever!
Oh, why art thou silent, thou voice of my heart?
Oh! why art thou silent, Kathleen Mavourneen?
Kathleen Mavourneen, awake from thy slumbers!
The blue mountains glow in the sun's golden light;
Ah, where is the spell that once hung on my numbers?
Arise in thy beauty, thou star of my night!
Mavourneen, Mavourneen, my sad tears are falling,
To think that from Erin and thee I must part!
It may be for years, and it may be forever!
Then why art thou silent, thou voice of my heart?
Then why art thou silent, Kathleen Mavourneen?

L'ALLEGRO

Milton wrote two exquisite companion poems, calling them by Italian titles: L'Allegro the lively man, and Il Penseroso, the thoughtful man. In this selection we follow the lively man's day from dawn until night.

AND if I give thee honour due,
Mirth, admit me of thy crew,
To live with her, and live with thee,
In unreprovèd pleasures free;
To hear the lark begin his flight,
And, singing, startle the dull night,
From his watch-tower in the skies,
Till the dappled dawn doth rise;
Then to come, in spite of sorrow,
And at my window bid good-morrow,
Through the sweetbriar, or the vine,
Or the twisted eglantine.
While the cock, with lively din,
Scatters the rear of darkness thin,
And to the stack, or the barn-door,
Stoutly struts his dames before,
Oft listening how the hounds and horn
Cheerly rouse the slumbering morn,
From the side of some hoar hill,
Through the high wood echoing shrill.
Sometime walking not unseen
By hedge-row elms, on hillocks green,
Right against the eastern gate,
Where the great Sun begins his state,
Robed in flames, and amber light,
The clouds in thousand liveries dight.
While the ploughman, near at hand,
Whistles o'er the furrow'd land,
And the milkmaid singeth blithe,
And the mower whets his scythe,
And every shepherd tells his tale
Under the hawthorn in the dale.
Straight mine eye hath caught new pleasures
Whilst the landscape round it measures,
Russet lawns, and fallows gray,
Where the nibbling flocks do stray,
Mountains on whose barren breast
The labouring clouds do often rest:
Meadows trim with daisies pied,
Shallow brooks, and rivers wide.
Towers and battlements it sees
Bosomed high in tufted trees,
Where perhaps some Beauty lies,
The Cynosure of neighbouring eyes.
Hard by a cottage chimney smokes
From betwixt two agèd oaks,
Where Corydon and Thyrsis, met,
Are at their savoury dinner set
Of herbs, and other country messes,
Which the neat-handed Phillis dresses;
And then in haste her bower she leaves
With Thestylis to bind the sheaves;
Or, if the earlier season lead,
To the tann'd haycock in the mead.
Sometimes with secure delight
The upland hamlets will invite,
When the merry bells ring round,
And the jocund rebecks sound
To many a youth and many a maid,
Dancing in the chequer'd shade;
And young and old come forth to play
On a sun-shine holy-day,
Till the live-long day-light fail:
Then to the spicy nut-brown ale,
With stories told of many a feat,
How faery Mab the junkets eat.
She was pinch'd, and pull'd, she said;
And he, by friar's lantern led,
Tells how the drudging Goblin sweat,
To earn his cream-bowl duly set,
When in one night, ere glimpse of morn,
His shadowy flail hath thresh'd the corn
That ten day-labourers could not end;
Then lies him down the lubber fiend,
And stretch'd out all the chimney's length,
Basks at the fire his hairy strength;
And crop-full out of doors he flings,
Ere the first cock his matin rings.
Thus done the tales, to bed they creep,
By whispering winds soon lull'd asleep,
Towered cities please us then,
And the busy hum of men,
Where throngs of knights and barons bold,
In weeds of peace high triumphs hold,
With store of ladies, whose bright eyes
Rain influence, and judge the prize
Of wit or arms, while both contend
To win her grace, whom all commend.

PENSEROSO

The reflective man spends his evening watching the moon, or in a fire-lit room. As night wears on he betakes himself to a lonely tower to read of olden days. Morning dawns cloudily, and midday finds him in a retired spot.

. . . I walk unseen
On the dry smooth-shaven green,
To behold the wandering Moon
Riding near her highest noon,
Like one that had been led astray
Through the heaven's wide pathless way,
And oft, as if her head she bow'd,
Stooping through a fleecy cloud.
Oft on a plat of rising ground
I hear the far-off curfeu sound,
Over some wide-water'd shore,
Swinging slow with sullen roar:
Or if the air will not permit,
Some still removèd place will fit,
Where glowing embers through the room
Teach light to counterfeit a gloom;
Far from all resort of mirth,
Save the cricket on the hearth,
Or the belman's drowsy charm,
To bless the doors from nightly harm.
Or let my lamp, at midnight hour,
Be seen in some high lonely tower,
Where I may oft out-watch the Bear
With thrice-great Hermes, or unsphere
The spirit of Plato, to unfold
What worlds, or what vast regions hold
The immortal mind, that hath forsook
Her mansion in this fleshly nook:
And of those dæmons that are found
In fire, air, flood, or under ground,
Whose power hath a true consent
With planet, or with element.
Sometime let gorgeous Tragedy
In scepter'd pall come sweeping by,
Presenting Thebes, or Pelops' line,
Or the tale of Troy divine;
Or what (though rare) of later age
Ennoblèd hath the buskin'd stage.
But, O sad Virgin, that thy power
Might raise Musæus from his bower,
Or bid the soul of Orpheus sing
Such notes as, warbled to the string

Drew iron tears down Pluto's cheek
And made Hell grant what Love did seek!
Or call up him that left half-told
The story of Cambuscan bold,
Of Camball, and of Algarsife,
And who had Canacé to wife
That own'd the virtuous ring and glass;
And of the wondrous horse of brass
On which the Tartar king did ride:
And if aught else great bards beside,
In sage and solemn tunes have sung,
Of tourneys, and of trophies hung;
Of forests, and enchantments drear,
Where more is meant than meets the ear.
Thus, Night, oft see me in thy pale career,
Till civil-suited Morn appear,
Not trick'd and frounced as she was wont
With the Attic Boy to hunt,
But kercheft in a comely cloud,
While rocking winds are piping loud,
Or usher'd with a shower still,
When the gust hath blown his fill,
Ending on the rustling leaves,
With minute-drops from off the eaves.
And when the sun begins to fling
His flaring beams, me, goddess, bring
To archèd walks of twilight groves,
And shadows brown, that Sylvan loves,
Of pine, or monumental oak,
Where the rude axe with heavèd stroke,
Was never heard the nymphs to daunt
Or fright them from their hallow'd haunt.
There in close covert by some brook
Where no profaner eye may look,
Hide me from day's garish eye,
While the bee with honey'd thigh
That at her flowery work doth sing,
And the waters murmuring,
With such concert as they keep
Entice the dewy-feather'd Sleep;
And let some strange mysterious dream
Wave at his wings, in aery stream
Of lively portraiture display'd,
Softly on my eyelids laid:
And, as I wake, sweet music breathe
Above, about, or underneath,
Sent by some spirit to mortals good,
Or the unseen Genius of the wood.
But let my due feet never fail,
To walk the studious cloister's pale,
And love the high-embowèd roof,
With antique pillars massy proof,
And storied windows richly dight
Casting a dim religious light:
There let the pealing organ blow,
To the full-voiced quire below
In service high and anthems clear,
As may with sweetness, through mine ear,
Dissolve me into ecstasies,
And bring all Heaven before mine eyes.

THE ARGUMENT OF HIS BOOK

Herrick was delighted with the rural customs that survived in his quiet little Devonshire parish, and in many of his poems celebrated them. Even from this one stanza we can feel with what delicate flavor he relished them.

I SING of brooks, of blossoms, birds, and bowers,
Of April, May, of June, and July flowers;
I sing of May-poles, hock-carts, wassails, wakes,
Of bridegrooms, brides, and of their bridal cakes.
I write of Youth, of Love, and have access
By these, to sing of cleanly wantonness;
I sing of dews, of rains, and, piece by piece,
Of balm, of oil, of spice, and ambergris.
I sing of times trans-shifting; and I write
How roses first came red, and lilies white;
I write of groves, of twilights, and I sing
The court of Mab, and of the Fairy King.
I write of Hell; I sing, and ever shall,
Of Heaven, and hope to have it after all.

ON THE LATE MASSACRE IN PIEMONT

In May, 1655, all England was horrified by the news of the massacre of the Vaudois Protestants by the troops of the Prince of Piemont, in consequence of their disobedience to an edict requiring them either to leave their native valleys or to conform to the Catholic religion.

AVENGE, O Lord, thy slaughtered saints, whose bones
Lie scattered on the Alpine mountains cold;
Even them who kept thy truth so pure of old,
When all our fathers worshipped stocks and stones,
Forget not: in thy book record their groans
Who were thy sheep, and in their ancient fold
Slain by the bloody Piemontese, that rolled
Mother with infant down the rocks. Their moans
The vales redoubled to the hills, and they
To Heaven. Their martyred blood and ashes sow
O'er all the Italian fields, where still doth sway
The triple Tyrant: that from these may grow
A hundred-fold, who, having learnt thy way,
Early may fly the Babylonian woe.

SONNET

ON HIS HAVING ARRIVED TO THE AGE OF TWENTY-THREE

John Milton was conscious from the first of his high calling as a poet. Though upon his twenty-third birthday he knows that his progress is slight, yet he is satisfied that when the time is ripe this destiny will be fulfilled.

HOW soon hath Time, the subtle thief of youth,
Stolen on his wing my three-and-twentieth year!
My hasting days fly on with full career,
But my late spring no bud or blossom shew'th.
Perhaps my semblance might deceive the truth
That I to manhood am arrived so near;
And inward ripeness doth much less appear,
That some more timely-happy spirits endu'th.
Yet, be it less or more, or soon or slow,
It shall be still in strictest measure even
To that same lot, however mean or high,
Toward which Time leads me, and the will of Heaven:
All is, if I have grace to use it so,
As ever in my great Task-master's eye.

A PLANT'S STRUGGLE FOR LIFE

CONTINUED FROM 222

UP to a certain point the outer world is what we may call a friendly home for living creatures. They are not strangers in a strange land.

Thus the circulation of water by mist and cloud, wind and rain, helps them greatly. The atmosphere is a useful curtain, and it contains the Big Four elements—carbon in the form of carbon dioxid, hydrogen in the form of water-vapor, free oxygen which has been formed for the most part by green leaves, and abundance of free nitrogen which a few plants are able to capture. There are many other ways in which the earth is hospitable to living creatures, and the question rises, Why must plants and animals struggle as they do?

The outer world is, in a measure, friendly to plants, but it is very changeful. Not only are there regular changes to be faced—night after day, winter after summer—but there are irregular happenings, such as tempests, floods, hailstorms, drought and severe frost.

Just as we, in a small way, must change our clothing according to the season and weather, so in a deeper and subtler way the plant must. This is the *struggle with fate;* and a great student of plants pointed out that the plant's struggle with drought at the edge of the desert was as real as the plant's struggle for room and light in the crowded jungle. Where water is abundant at a rainy season, but scarce for a long time, we find water-storing tissue, as in cactuses. There is a thickening of the plant's skin, a reduction of foliage, and the stem becomes green. When the cold is apt to be excessive, we find many precautions, which have become in the course of time established, all without taking thought for the morrow.

The second reason for struggle is to be found in the rate at which many plants multiply. The river of life is always overflowing its banks. A single plant of hedge-mustard may produce 730,000 seeds, and it has been calculated that if each seed germinated and developed into a plant which seeded, the members of the next generation would be touching one another all over the earth. Of course, this does not happen —*because of the struggle for life.* The director of Brooklyn Botanic Garden tells us that a fern of moderate size produces every year about fifty million spores. If each of these spores, he says, ultimately produced a mature fern plant, and if we allowed only one square foot of elbow-room for each plant, the progeny of one parent only, in one season, would require at least fifty million square feet, or nearly two square miles. If each of these plants in turn produced fifty million offspring the next

season, the descendants of only one fern plant would, in only two years, cover the stupendous area of nearly ninety million square miles, or an area greater than the land surface of the globe.

We see, then, that plants have to struggle not only because the outside conditions are very changeful, but also because of the rate at which plants tend to multiply.

THE LIVING CREATURE ROLLS UPHILL AS WELL AS DOWN

But is there not a third reason for the struggle—a reason wrapped up with the central secret of life? Every vigorous living creature is *always asking for more.* It is of the nature of the living creature to assert itself, and to answer-back to difficulties and limitations.

Just as the loosened stone rolls down the hillside, crashing through obstacles until it reaches the level ground or is jammed, so the living creature soon gets some way on and will not be hindered. But the living creature rolls uphill as well as downhill—that is its secret. Plants and animals alike may be compared to clocks that can wind themselves up. We must not dwell on this reason for struggle, for it is very difficult; but the fact is that the more a plant succeeds, the more it asks for. It is a hustler and a jostler, though it looks so quiet. To put it in another way, the plant does not readily submit to being hindered by difficulties and limitations.

John Burroughs tells of a young plant which burst its way through the asphalted hard surface of the pathway on the side of a street. It had been buried alive, but it would not submit. Without any tools or explosives it broke its way out—by the gentle force of growing. So we see that plants must struggle—because the outer world is changeful, because they tend to have such big families, and because it is their very nature to assert themselves against difficulties.

CARING FOR SELF AND FOR OTHERS IS THE BUSINESS OF LIFE

For plants, as for animals, the business of life is twofold—caring for self and caring for others; and the most important part of caring for self is the quest for food.

We have already seen that ordinary green plants feed on carbon dioxid which is part of the atmosphere, and absorbed by the leaves, on water, usually from soil, and on salts like saltpetre, which are taken in by the rootlets along with the soil-water. As there is in all ordinary cases an abundance of this simple kind of food, the struggle must be *in tapping the supply and competing with other plants* which are doing the same. We shall come to this competition later; it is useful, first of all, to notice some of the more or less unusual ways in which plants feed.

In boggy and marshy places the soil is poor in nitrogenous salts like saltpetre, and this makes plant life difficult. For living matter is in part a complicated mixture of nitrogenous carbon compounds called proteins—like the gluten which is a valuable part of bread—and if the living matter is to be kept going and growing, there must obviously be *nitrogenous* food. Therefore, boggy and marshy places cannot be peopled except by plants which have some special fitness for thriving in the poor and peculiar soil. Immediately we see why bogs and marshy places should show so many insect-eating plants, like sundew, butterwort, Venus's fly-trap, bladderwort and some pitcher plants, which are able to eke out the scanty nitrogenous food supplies by capturing insects and other small animals.

THE PLANT THAT FLOATS IN THE POOL WITH HUNDREDS OF LITTLE TRAPS

The bladderwort floats in the pool in the marsh; it has not even roots; it absorbs everything through its green leaves and shoots. But it has hundreds of little traps, each about the size of the head of a blanket-pin, and these serve to capture water-fleas and other small fry. The small animal pushes its head against a swinging door and enters the trap. The door closes automatically behind it, and the prisoner dies, and is digested.

The beautiful sundew spreads its leaves on the bog-moss—each somewhat like a flattish spoon with a narrow handle. The expanded part of the spoon is surrounded by tentacles which are tipped with dew-like drops of sticky secretion. These tentacles are exquisitely sensitive to the touch of a small insect. They bend inward like the fingers of a closing hand. The insect is securely captured, digestive juice is poured out upon the prisoner, and what is useful in its body is dissolved and absorbed. The tentacles then expand again. So the sundew flourishes.

In the same way, but less sensationally, insects are captured by the glistening, light green leaves of the butterwort, which

The leaves of Venus's fly-trap close like a spring trap over insects that alight on it. The plant then proceeds to digest the body of the insect.

Nature has endowed the British gorse with prickly spikes as a defense against browsing animals. The gorse therefore grows freely on open heaths.

The acids of the pitcher plant digest all the insects attracted into it by the honey glands.

The force exerted by a plant as it grows — a blade of grass that has pushed through a piece of root.

The cup on the stem of a teazel plant fills with rain and drowns all the insects that fall in.

The hairs on the stem of the begonia serve as a rampart against many climbing insects.

Clusters of mistletoe, the parasite that makes its home both on the oak tree and on the apple tree.

The convolvulus, struggling to the sunlight, winds itself around the stem of a neighbor.

are so often spread in starfish-like fashion on the sides of the ditches in the bog. The margins of the sticky leaves curl inward and shut in entangled flies, which are then digested by the secretion of numerous glands on the surface of the leaf. It is interesting to drop a leaf into a test-tube half full of milk to see the changes.

Another mode of life is thievish, or *parasitic*, when one plant filches food-material from another. This is a sort of back-door escape from the struggle for existence. Farmers know that the pasture land is bound to be poor when there is great abundance of the beautiful little flowers called eyebright. And why is this?

The soil does not yield enough to keep ordinary plants going; those that get on there must have some peculiarity, such as very long roots, or very much branched roots, and very much cut-up leaves, as in millfoil, or very long not-overlapping leaves, like grasses. The little eyebright has discovered another way out—hardly worthy of its beauty and its pretty name. It is a root-parasite. Some of its rootlets fit on to the rootlets of the grass like a saddle on a horse, and there is absorption of supplies from the grass. This weakens the grass, of course, but it is also an indication that the soil is far from generous.

THE CLIMBING DODDER AND HOW IT STEALS ITS FOOD

The thievish habit seen in the eyebright is found also in the yellow-rattle and in the louse-wort. Farmers say that sheep get out of condition where the louse-wort is very abundant, and they used to blame the plant for giving the sheep lice! What this means is probably that louse-wort, as a root-parasite, manages to thrive in very poor pasture. It is the poverty of the pasture that weakens the sheep.

The dodder is a rather beautiful climbing plant that has lost the usual green pigment called chlorophyl. It twines round the stems of nettles, hops, wheat and other vigorous plants, and sends its suckers into the zone of the stem—the bast—where the nutritive materials manufactured in the leaves pass down to places of storage. The dodder at first gets its water and salts from the soil, but afterward the connection with the ground withers away, and it lives on its host. Its life is a stratagem.

Very different is the mistletoe, which has plenty of green pigment but no connection with the ground. The thrush eats the white berry with its sticky pulp, and the seed, passed through the bird's food canal undigested, is deposited on the branch of a tree, such as an apple or an oak. Sometimes, perhaps, the thrush, having failed to swallow the sticky fruit, wipes its bill on the branch, and the seed is anchored. In any case, the seed of the mistletoe germinates on the branch of a tree, and sends its rootlets into the wood-zone of the stem, where the crude sap, consisting of soil-water and dissolved salts, passes up. Being green, the mistletoe plant can make plenty of carbon compounds on its own; but, having no connection with the earth, it must steal water and salts from its host. These are but three examples of plant parasites—eyebright, dodder and mistletoe—but they illustrate this seamy side.

THE BIGGEST FLOWER IN THE WORLD AND WHERE IT GROWS

Another possibility in the quest for food is to batten on the dead. Many bacteria, many molds and rusts, besides some big fungi, live on living plants; many bacteria and some molds live on living animals. But others feed on what is dead and rotting, and they are called *saprophytes*. We are familiar with the fungoid plants that feed on decaying leaves and branches, utilizing the ready-made organic matter which, being without green pigment, they cannot make for themselves.

Many of these saprophytes play an important part in keeping the earth clean. Among the saprophytes are some flowering plants of high degree which have lost caste and become, to a greater or less extent, dependent upon rotten vegetable matter. The biggest flower in the world (*Rafflesia*), sometimes three feet across, is the flower of a saprophyte that grows on the floor of the tropical forest.

HOW SOME PLANTS ENTER INTO PARTNERSHIP, AND WHY

Let us look for a moment at the very interesting way in which plants enter into partnership with other plants, and occasionally with animals, to the great advantage to both parties; it is one of the alternatives in the quest for food. There are bacteria which form partnerships with the roots of clovers, peas, lupines and other plants of the bean family, and enable them, in some mysterious way, to capture and utilize the free nitrogen of the air. There

are many fungi which wrap themselves round the roots of plants and form a most useful sponge. The heather gets on well, as we have mentioned, on very poor soil, *because it has a partner-fungus.* This is another solution of natural difficulties.

In the early summer we see men and boys busy thinning the cotton with a hoe, destroying several and leaving one. Sometimes we see gardeners on their knees laboriously thinning or singling out the young carrots. There are too many young plants; they crowd one another and dwarf one another. If the farmer or gardener is to get profitable full-grown plants, he must thin them out. Similarly, in wild nature there is natural thinning. The young plants that get a good start, either through some virtue of their constitution or some accident of environment, elbow out their neighbors. There is ceaseless sifting. As Tennyson said of Nature, "So careful of the race she seems, so careless of the single life."

But while the sifting is often effected in early life by a great "infantile mortality" of seedlings, there are

A cactus of Arizona which grows more than forty feet high.

The prickly cushion cactus.

The prickly flowers of the desert.

sheltered and luxurious places where many plants get past the juvenile stages, and where there is extraordinary crowding, and, therefore, great competition for foothold, for light and for air. Such places are sheltered—self-sown woods, tropical jungles, thick-set hedgerows, and rich meadows. We get a key to what goes on in such places if we realize that plants are struggling, each in its own way and all in the plant's way, to find self-expression, to get on, to obtain satisfaction, or to overcome obstacles and limitations.

What light is shed on the variety of climbing plants when we understand that they are conquerors in a fight! They have remained young and mobile in their stems, or leaf-stalks, or tendrils, or some other part of their body, and they have risen on the shoulders of their neighbors to thrive on fresh air and abundant light.

It is very interesting to think of the different ways in which plants escape from deadly overcrowding and the literal shadow of death. Brambles, with their long shoots and gripping prickles, are

scramblers; and so is the wild mustard, which is helped by the roughness of its rapidly growing shoots. The ivy is a *root-climber,* giving off numerous brown roots on the shady side of the lanky stem. Then there are *twiners,* with stems that encircle the support, as in the case of honeysuckle and dodder, and the lianas of the tropical forest. But the artists in the business are the *leaf-climbers* and the *tendril-bearers,* where the leaf-stalk, or a specialized sensitive filament, bends round a support. Think of clematis, vine, bryony and pea; what masterpieces they are!

We see a new significance in the spiral arrangement of leaves on the stem, for this means that they shadow one another less; in the mosaic of leaves on the horse-chestnut branch, where many leaves make the most of the available light without overlapping; of the success of long, grassy leaves that run parallel without overlapping; of much cut-up leaves, like millfoil, which have an enormous surface for absorption and exposure to light, like countries with a big coast-line. We must realize the intensity of the struggle. Every meadow is like a tropical jungle, every hedgerow like a tropical forest.

THE MONGOOSE THAT FIGHTS A SNAKE WITH TEETH AND WITS

When man struggles with wild beasts or poisonous serpents or injurious insects, his weapons are often *ideas.* His struggle is rational. When a mongoose fights a snake, his weapons are not only teeth but *wits.* His struggle is intelligent. When a mother digger-wasp struggles with a cricket, which she will paralyze to form food for her young ones, her weapons are not only her sting but that inborn power of doing apparently clever things which we call instinct.

Now, the struggles of plants against animals are at a lower level than all these. There is no reason to believe that the plant ever really *knows* what it is doing, even when it catches a fly, and that is the most active answer-back that a plant ever gives to an animal. In most cases all that we can say is that in the course of time some plants have changed in the direction of having stings or poisons, thorns or spines, hard skins or unpalatable crystals, which have turned out to be very profitable—indeed, life-saving—in warding off the attacks of animals.

The answer-back is an unconscious constitutional change which pays; and sometimes the change occurs without there being, so far as we can see, any need for it. We must not learn what we shall afterward have to unlearn. The lilies of the field do not toil or spin; and no plant thinks out devices which save its life in the struggle for existence.

THE STRUGGLES OF PLANTS GO ON UNCEASINGLY

To come to the facts of the case, let us give two or three examples of the ways in which many plants are protected from the assaults of animals. Everyone who loves a garden knows that among the worst enemies of plants are the snails and slugs, and their depredations go on all over the world. But there are some plants that snails leave alone, because of hard skins, rough prickles, stiff hairs, poisonous stings, strong odors and other defenses. Thus there are few snails that attack the European plant of the woods called cuckoo-pint, a near relative of our jack-in-the-pulpit; and one good reason for this is that the leaves are crowded with minute sharp crystals which would pierce and irritate the lips of the snail.

The struggles of plants are world-wide, rarely-ceasing and many-sided. They include all the answers-back, all the thrusts and parries, that plants make against the difficulties and limitations that beset them. There are struggles with fate—the physical world; struggles with fellows—other plants in the crowded area; and struggles with foes—hungry and injurious animals of high and low degree. There is struggle for food, for foothold, for freshness, for light, for moisture—for everything a plant needs. There are ways of evading the intensity of struggle—as, for instance, by becoming a parasite, but this usually means some degree of degeneration.

THE FIGHT FOR THE PLACE OF A PLANT IN THE SUN

The great fact for plants and animals is the same—that success means struggle. Not only must plants struggle to win a place in the sun; they have often to struggle to keep it.

But struggle among plants is usually a dreamy business; it includes all the answers-back that it is in them to make as they care for themselves and for their race. The central principle of all life that goes forward is: *Test all things, and hold fast that which is good.*

THE NEXT STORY OF PLANT LIFE IS ON PAGE 503.

HOW TO MAKE A SIMPLE ONE-TUBE RADIO SET

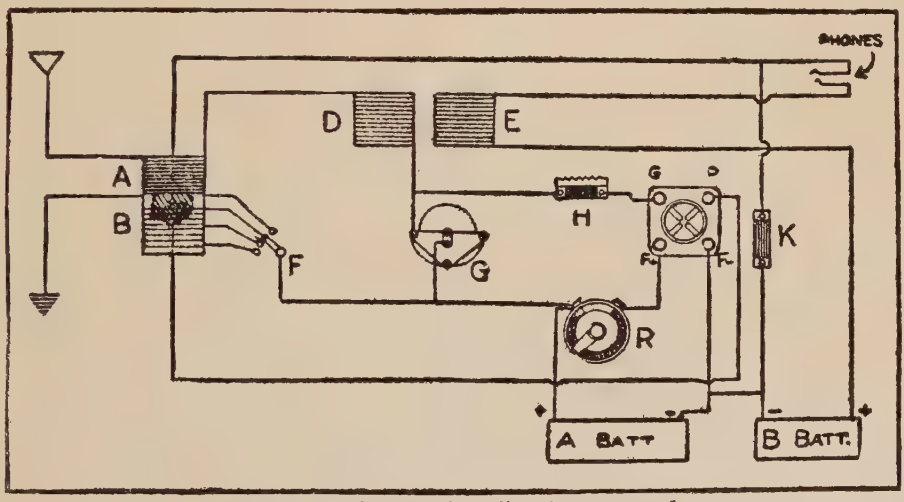
HAVE you joined the enthusiastic ranks of the many thousand boys who own radio sets? If you are not a radio amateur as yet, or if you have failed to make a successful receiving outfit, try this simple one-tube set. You will be interested to find that only a few parts need be purchased for this easily constructed receiver.

CONTINUED FROM 234

This is a set of few parts and simple construction. In fact, after much experimenting with simple one-tube sets it has been found that the single-tube receiver shown in the accompanying diagram can be recommended to you without reservations. Furthermore, this set is powerful enough to equal the ordinary two-tube set, including a step of audio-amplification, and it will get distance.

The parts needed include:

One 4-inch tube, six inches long.
One rotor, three inches in diameter.



How the parts of a one-tube radio set are arranged.

Two 4-inch coils, two inches long.
F, a switch and four switch points.
G, .00025 variable condenser.
H, Grid leak and condenser.
K, By-pass condenser, .001 mfd capacity.
R, rheostat, 6-ohm resistance.
Tube socket, phone jack and four battery terminals.

The tube socket should be designed for

the dry tube detector, a WD-12, as the set described was originally made for this. This means a dry A, as well as a dry B, battery.

Winding Coils. The first coil to wind is the secondary (B) of the antenna inductance (No. 22 DCC wire may be used). First wind 35 turns of this wire so that the last turn will reach about the middle of the tube (the turns will have to be rather close). Skip a half inch and continue with 25 more turns, taking a tap off the tenth and twentieth and last of these turns. Now bore a hole for the shaft through the tube, where the half-inch space was left. The rotor (C) fits inside the tube at this shaft. It is made by winding 17 turns of the same wire on each side, making 34 in all.

Untuned Primary. Wrap two turns of thin wrapping paper around the first 35 turns of coil B and on it wind the primary A. This consists of 15 turns of No. 22 wire, spaced evenly so that the entire primary will cover the first 35 turns of the secondary. Be sure to wind the primary in the same direction that the secondary is wound. The other two coils, D and E, are alike. They consist of 20 turns of wire on the smaller tubes. They are fastened upright on the base, and must be exactly one inch apart.

With the use of WD-12 tubes, all that is needed of power is 45 volts on the plate and 1½ volts on the filament. You are now a radio amateur of the first order. If you have carefully followed the directions in constructing this set, your receiving difficulties should be over when you "tune in."

HOW TO PAINT WITH STENCILS

IT is possible, of course, to ornament a table-cover with all sorts of beautiful work, but one of the simplest and most effective ways is to stencil a pattern to form a border.

Stenciling is a type of decorative painting. It is used upon walls and ceilings as well as upon smaller things, such as curtains, book-covers, dresses, cushions, and so on.

Many big buildings, like concert-halls and churches, are decorated inside entirely by stenciling, but it is also quite easy to make simple little patterns for borders, and with them to decorate little things of our own. But how is it done?

Preparing the stencil plate.

Stencil brush.

First of all, we must understand what is meant by a "stencil plate." It is simply a piece of stiff paper with a pattern cut out of it. The pattern is so arranged that when the "plate" is laid on any piece of material, colors can be painted through the holes right on to the material in the exact shape of the cut-out pattern. There are three great advantages in this method of painting: The outline of the pattern is always very neat; the pattern itself can be repeated any number of times (or on any other material) from the same plate; and beautiful shaded effects can be obtained very easily.

Now we are going to see how to make a stenciled border.

Choose a simple flower—say, a tulip—and draw it carefully on a piece of rather stout oiled paper. Draw it as *simply* and *severely* as possible, leaving out all detail. It will look something like picture 1.

Now go round the outline of each leaf and petal, as is shown in picture 2, inclosing each portion of leaf and petal in a separate space. When we have done this, and made all the lines between the spaces quite even in width, we must shade in each space with pencil-lines—picture 3 shows us how—as a guide to the next step.

Next, get a sharp penknife; lay the paper on a sheet of glass and carefully cut out each shaded-in piece, going round the outline with the point of the knife, and keeping the paper pressed firmly on the glass. Be very careful *not to cut beyond the shaded portion.*

When each little piece is cut out, we have made our first stencil plate. But before we can use it we must get a half pint of varnish from the painter, and varnish and paint over both sides of the plate. The varnish will harden and prevent paint soaking into the plate and rotting it. When both sides are varnished we must hang it up to dry, either near the window or in the open air. Suspend it by a thin string loop put through a pinhole in one corner, and see that it does not touch anything, for it is now rather sticky. We must not use it till it is dry and hard.

Festoon of apples and leaves for decorating lampshades.

The kind of brushes to use are short, round, stumpy ones of soft hog-hair; they can be purchased at most stores.

We can use ordinary artist's water-color paints in pans. These cost but a few cents. The choice of color rests with ourselves. Blue, red and yellow we should have. These can be mixed to give other colors and shades.

Now we must begin to think about the table-cover which we are going to make.

Buy a piece of cheesecloth or a nice soft curtain cloth, which can easily be bought at any dry-goods store. Cut it into a yard square. Straighten out one edge, and with drawing-pins fix it to a drawing-board or a flat table. Find the middle of the side (that is, 18 inches from the corner); on that point, and about 3 inches away from the edge of the cotton, lay the stencil plate quite straight. The stalk should point toward the edge and the flower inward. Fix the plate in position *at the top* with two drawing-pins. Slightly moisten the paint in the pan, and rub the brush on it, then with a dabbing action go over all the holes forming the design. Choose another color (and another brush) for the leaves and stem, and do those in the same way. Then from the bottom gently lift the plate a little way and peep underneath. We shall be able to see how it looks, and whether we have got our colors deep enough.

Laurel-leaf curtain border.

How to make use of the veining in a leaf for "ties."

Here are some things that we must try to remember:

1. Be careful not to get the paint too wet. Never dip the brush in water, but always moisten the paint itself, then rub the brush on the paint.

2. Always paint with a succession of dabs. Do not use the brush as an ordinary house-painter does, or you will make a smear and spoil the even edge of the original pattern.

3. Obtain the shaded effect by dabbing more at the base of the tulip petals than at the tips.

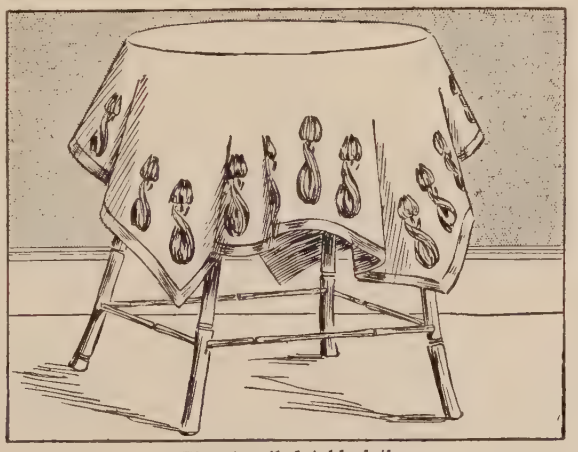
In choosing color, a deep yellow (almost an orange) shading into pale primrose for the flowers, and a dark green tipped with brown for the leaves, will look well.

Now we have to decide how close we want the next tulip to be, and make a small pencil-mark on our cotton the necessary distance away. Space the remainder, along the side, with tiny pencil-marks as a guide. Unpin the plate, replace it over one of the guide-marks, and continue to paint. Probably we shall find that about nine tulips will space out well in a yard length—four on each side of the centre one. When we have done the other sides and hemmed the edge, our cloth will be finished, and look very charming, well worth much more than it costs.

If we keep our plate carefully pressed between the leaves of an old book, some other time we shall be able to use the design for something else — perhaps a border of tulips round a bedroom wall, or a single one to decorate a plain holland book-cover. Of course it will be better to begin by using our plate on an old piece of stuff, or on a piece of paper, before actually working on the table-cover; then we shall learn how wet the paint should be, and how to dab properly. We might also experiment with a little shading from dark to light tones of color.

We must notice the stenciling used in any buildings which we visit, and have a good look at it; we shall soon learn to detect it by the separateness of each little bit formed by the cutting out. Of course, if each little piece were not separate, the design would not hold together in the plate. The pieces which are left between the cut-out portions are called "ties." We must always pay great attention to them when we make a new pattern.

There are many ways of using stencils and making elaborate and beautiful patterns with them. Sometimes one is used over another, the very big ones being made of tin or sheet copper. But these are very difficult to make, for they require the skill of an artist. Nevertheless, if we follow these directions we shall soon be able to make many useful and beautiful little patterns for ourselves, which will come in useful just now when we are beginning to think about the making of our Christmas presents.



The stenciled tablecloth.

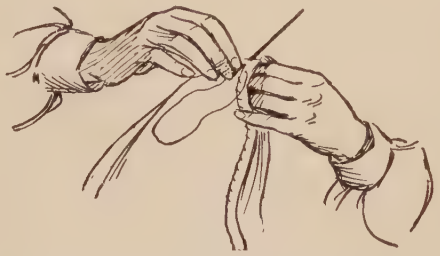
When once the principles have been grasped, it is no more difficult to decorate a wall with many impressions of a plate, arranged as a frieze, than to make one impression on a book-cover.

WHAT TO DO WITH A GIRL'S WORK BASKET

1. HOW TO USE THE NEEDLE

WE take it for granted that you have a work box, and here we show you the right way to use it. We are going to dress a doll. We shall cut out the clothes all by ourselves, and make them as our own clothes are made. First we shall make the little underclothes, one by one, and then the frock. But before we can do anything at all we must know how the different stitches holding the pieces together are made.

We all think that it is the easiest thing in the world to thread a needle, but the right way to do it is to thread it by the end just cut off the reel, making a tiny knot at the other end. If the thread is put through the needle at the opposite end all the gloss goes



1. How to hold the material for stitching.

out, the thread becomes woolly, knots and breaks off very easily. Always choose a needle that is just a little thicker than the thread. This will open the material enough for the thread to come through without any unnecessary pulling and tugging.

Now, if you want to know exactly how to hold the hands to do some good work, look at picture 1. You will see that the left hand holds the piece of material between the thumb and first finger, letting it fall loosely over the back of the hand, the little finger just holding it in place. The right hand holds the needle and pushes it in and out of the material, a thimble on the third finger helping to push the needle through. The picture shows the hands in position when doing a hem—which is, as we all know, a double fold of material, turned down and folded over to protect a raw edge. The width of the first fold of a hem should be about one-third the width of the hem required, but in very narrow hems the first fold is the same width as the second. If, however, you intend to sew very fine material, such as muslin, the fold must be the same size as the hem, otherwise the rough edge will show through.

When you have decided what the size of the hem should be, turn the double fold and press it down firmly with your nail, then baste it, with long, even stitches. This will save a lot of time, for the hem will keep pressed down in position, and it will help to get the work straight and even. The needle is then put in the material, as you can plainly see in picture 2, the stitches being done from right to left in a slanting position.

There are many different kinds of stitches, but for our present purpose it is necessary to know only a few of them. The running stitch (picture 3) is one of the most useful to learn, for it is with this stitch that seams are made and materials gathered.

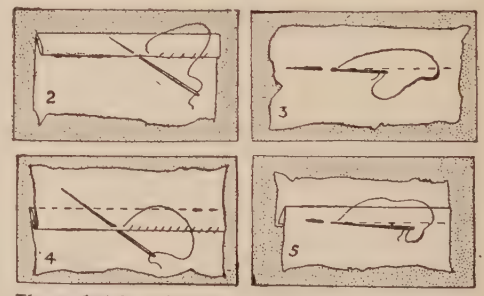
If you are anxious to learn how to do really beautiful sewing, try first on fine canvas, or on any other very coarse material, where the threads can be easily seen, taking two threads on the needle and going over two. You will be surprised to find how easily the hand and eyes will be trained to work evenly and regularly, until you can work quite pretty little stitches on any material without counting the threads, which is always a slow and tedious method of working.

When you can do the hemming and running stitches quite evenly, you have mastered the most difficult part of sewing, for all the other stitches are more or less made from these two.

If you look at picture 4, for example, you will see a little pattern of running and felling, which always looks full of difficulties to little girls, although it is simply running and hemming. Two pieces of material are put close together, the back piece slightly overlapping at the top to allow for the folding over of the raw edge, and joined together, on the wrong side, by running stitches. The material is then opened under the seam, laid flat, and the two edges folded over like an ordinary hem.

A glance at the picture will show the work far better than it can be explained.

The easiest way for little girls to do running and felling is by French seams. It will probably be the most popular way of doing the seams in dolly's underclothes. If you look at picture 5 you will see that this kind of seam is simply a double row of running

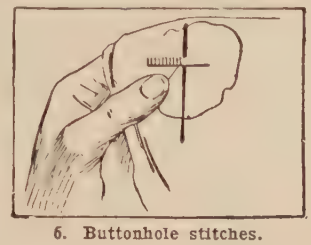


These sketches show you how to make the different stitches. 2 is a hemming stitch, 3 running, 4 running and felling, and 5 a French seam.

stitches. The first row is done in the ordinary way, then the raw edges are cut as short as possible, and the seam turned inside out,

a second row of stitching giving perfect neatness in the finished work. You must, however, remember when doing these seams that the first row of running, instead of being done on the wrong side, as for running and felling, is always done on the right side, the second row putting the first one out of sight.

Gathering is done with exactly the same stitches as running, only it must be done with strong cotton so that it will not break. The thread is pulled to gather the fullness. No knots or joins must be allowed in the thread, or it will not come through the material to form the gathers. Measure the piece of stuff you want to gather, and take a piece of thread long enough to leave two or three inches to take hold of when you want to draw it. It is always better to do two or three rows of gathers in case one should break, besides giving more evenness.



6. Buttonhole stitches.

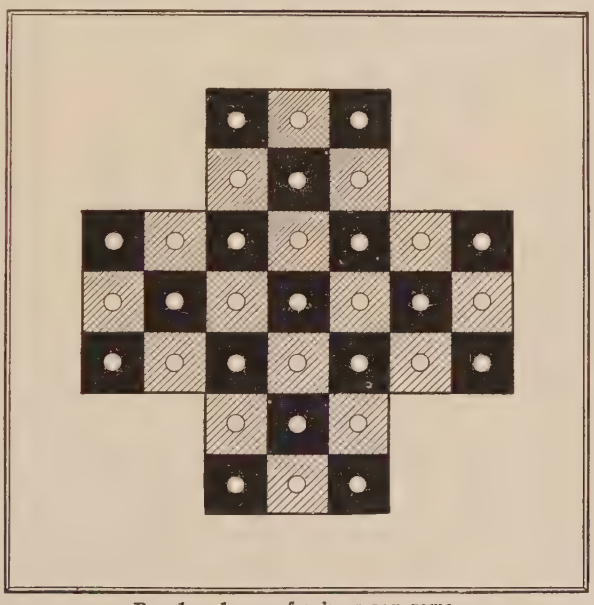
If the gathers are done on calico, or any other fine material for underclothes, when the thread has been drawn a thick needle should be used to stroke down the material between each gather.

Buttonhole stitches come next, and these are by no means too difficult to be attempted. They are really quite easy when you know the way. Try first on a piece of canvas or coarse flannel, and make very even and regular stitches quite close to each other. Picture 6 shows just how the stitches are made. Let the thread go under the point of the needle and pull the needle down gently, letting the thread cross over itself where the needle came out. If you follow these directions, and look at the picture, you will really be surprised how easy the stitch is. It is not only useful for buttonholes, but for embroidering flannel petticoats, as we shall see later.

HOW TO MAKE AND PLAY JUMP-PEG GAME

THIS fascinating game is good fun at all times, but it is especially suited for dull afternoons. It is easily made and is played by only one person at a time. The object of the game is to get all of the pegs off the board except one, which should be left in the centre hole. The pegs are removed by jumping with one over another, removing each peg jumped, as is done in playing checkers.

How to Make. Although the jump-peg game may be made from heavy cardboard, the following directions are given for constructing it from poplar or other soft wood because of the lasting qualities of wood. If you prefer the more permanent game secure one piece of poplar or other soft wood either ¾ or ⅞ of an inch by 9½ inches by 9½ inches, and one piece dowel rod ¼ of an inch by 48 inches. After squaring and planing the board as desired, mark off spacing for holes, making them 1 inch apart on centres, as shown in the accompanying drawing. Then bore holes to depth of ½ inch, using ¼ inch bit. Next cut 32 pins from the rod, making each pin 1½ inch long and slightly pointed on both ends. Now sand the board with No. ½ or any fine sandpaper. If desired, the board may be made more attractive by marking off 1 inch squares, as shown in the accompanying drawing. These squares can then be painted with two bright colors, as shown. Either water colors or paints may be used. Shellac with thin shellac (two coats must be applied) or wax with good furniture or floor wax.



Board and pegs for jump-peg game.

How to Play. The jump-peg game is played by filling with pegs all of the holes except the centre one. The player begins to play by jumping any peg over another into the hole and removing from the board the peg thus jumped. All jumps should be made in straight lines, either in a horizontal or a vertical direction. As explained at the outset, the purpose of this game is to remove all pegs except one from the board. This last peg should be left in the centre hole. This may look very easy, but it is much more difficult than it seems at first sight. The peg sometimes will not jump to the centre hole.

HOW TO MAKE CANDIES

WILL some one kindly explain why the recipes for candies are always tucked away in the back of the cook book? Perhaps they are hidden away in the back pages because they are lonesome.

No little girl ever waits until she has studied all the recipes in the front of the book before she makes candies. So right here in the very first volume we will give simple directions for making some very delicious candies.

This page is quite as much for boys, for what is more fun than a candy-making party on a cold or rainy day when we cannot go outside! The small boy—and the big one too—loves to wear sister's big cooking apron and take a hand in mixing things.

It is useful to know how to make candy, for sometimes we cannot find the varieties we want in the stores. Then, too, home-made candy is much better, purer and **really** cheaper than the kind we buy at the shop. A box of candy you have made yourself is a most welcome gift for a birthday.

Most people like candy, and that includes grown-ups as well as little folks. And why should we not enjoy good, wholesome candy, for it has its **own food** value. It is only cheap candy that is dangerous, so when making candy always use the best materials. Good butter, good sugar, fresh eggs and nuts cannot hurt anyone.

PEANUT TAFFY

THIS candy is very popular. The materials needed are 2 cups (1 pound) of sugar and 1 quart of peanuts. Shell the peanuts, remove the brown skins and chop. Sprinkle with ¼ teaspoon of salt. Put the sugar into a perfectly smooth granite pan, and place it on the range over a moderate fire, stirring constantly until the sugar is melted. Remove from the fire, add the peanuts, and pour into buttered tins. You must be quick, for if not removed right away, the sugar will caramelize, which means it will turn dark brown, or almost black.

In place of the peanuts 1 cup of halved walnuts, or 1 cup of coconut or crisp puffed rice may be added.

If you wish to make this candy in larger quantities for a fair, here is a rule to remember about the proportions. Measure the chopped nuts and use just the same quantity of granulated sugar as you have peanuts. Cut it into squares before it cools or it will have to be broken unevenly.

PENOCHE

THE materials needed are 2 cups of brown sugar, ½ cup of milk, 1 tablespoon of butter, ½ cup of pecan meats, and 1 teaspoon of vanilla. Put the sugar and the milk into a saucepan, and stir until the sugar dissolves. After it has boiled 10 minutes, test it. If it forms a soft ball in water, or if the candy thermometer reads 240°, remove from the fire. Stir in the butter, the chopped nuts and vanilla. When it is cool, cut into squares. If you want to vary the penoche, use 1 tablespoon of peanut butter instead of the nut-meats.

POPCORN BALLS

SOMETIMES we make popcorn and wish we knew how to make it look attractive to serve. Here is one way of making it delicious. Put 1 cup of granulated sugar, 1 cup of water, and ¾ cup of corn syrup or glucose into a saucepan, and stir constantly until it is dissolved. Cook until the candy forms a rather soft ball when tried in water, or until the thermometer **reads** 240°. To test it, roll between the fingers in the cold water. Remove from the fire, **add** 1 teaspoon of **vanilla**, and pour slowly over the popped corn, stirring it well. If you moisten your hands with cold water, it is easy to press a lump of corn into a ball.

PEPPERMINT CREAMS (UNCOOKED)

SOME people prefer to cook the fondant for peppermints, but it is much easier to make a fondant that does not require cooking. Here is a simple way to prepare it. Break the white of an egg into a dish, add a few drops of peppermint extract. Stir in a little confectioner's sugar, and gradually add more sugar until the mixture can be molded easily. Roll it with a rolling pin, and stamp it into rounds with a small cutter. Place the candies on waxed paper and let them dry.

BUTTERSCOTCH

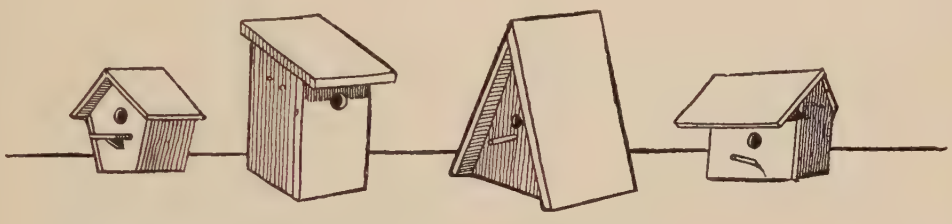
PUT 2 cups of granulated sugar, 2 tablespoons of butter, and 2 tablespoons of water all together in a saucepan, and cook without stirring. In 15 minutes try a little bit of the mixture in cold water. Mark into squares when cool.

Remember that too much cooking will make the butterscotch stringy or gritty.

BUILD A HOUSE FOR YOUR FAVORITE BIRD

WHERE is there a boy who isn't interested in birds and who wouldn't like to build a house for a bird? Perhaps you have wanted to build a bird-house for some time but haven't known just what kind of shelter your favorite bird needs. Well, it is found that there are three kinds of protection which birds seek. These are: the nest shelter, the food shelter, and the nest house.

If you were to make a *nest shelter* it would need to be open on one or more sides, as its roof and sides are intended merely to protect the nest from the rain and wind. In making a *food shelter* you would provide a roof, open sides, and a floor on which food could be placed. In case you decided to construct a *nest house,* you would make a suitable building in which birds might seek protection and rear their young.



Bird-houses that are easy to build.

If you wish to make nest houses, one of the most important things for you to observe from the outset is the kinds of birds which frequent the yards where you are planning to locate your houses. Many boys have failed to house their favorite birds because they did not know that the entrance openings vary with the size of the bird. Farmers' Bulletin 609, of the United States Department of Agriculture, on Bird Houses and How to Make Them, gives the following sizes for entrance openings which have been found highly satisfactory by several boys who have studied the habits and haunts of birds.

The diameters of the openings are as follows:

For blue birds, tree-swallows and hairy woodpeckers—2 inches.

For chickadees and Carolina wrens—1⅛ inches.

For house wrens—⅞ inch.

For house-finches, crested fly-catchers and red-headed woodpeckers—2 inches.

For tufted titmouses, white-breasted nuthatches and downy woodpeckers—1¼ inches.

Robins, barn-swallows and phœbes need one or more sides open.

Wood is found to be the most satisfactory material from which to make a bird-house. To avoid having it warp out of shape choose stock which is ⅜ inch, or even ½ inch in thickness. Then, too, you should construct your bird-house so that water will not run inside when it rains.

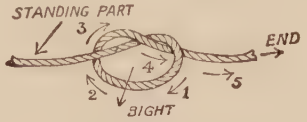
If possible, first decide upon the kind of bird for which you wish to make a house. The few suggestions which are given for bird-house designs may help you to determine the type of construction you will use. It is best to allow for cleaning through the side, the top or the bottom. Keep in mind that the size of your bird-house will depend upon whether you are making it for one family or for several families. In the latter case, partitions, and sometimes an additional floor, will be needed to separate them.

After you have decided these matters it is more satisfactory to make a working sketch on which you should place the exact dimensions of each piece of wood to be used. Next, select your wood, which should be over ¼ inch in thickness, for the reason mentioned, and shape each part to the desired size. Before making the entrance hole as shown, note, from the suggestions already given, the exact size of the opening which has been found most satisfactory for your favorite bird. For example, the opening for a house wren should be ⅞ inch in diameter. This opening should be placed quite near the roof so that the bird may have ample room to make its nest. To give proper ventilation you will need to make even smaller holes above the entrance and near the roof.

Regardless of whether you use brads, nails or screws, it is more satisfactory to set or countersink these deep enough that the heads may be covered with putty. Now you are ready to preserve your bird-house and improve its appearance with paint. Having decided about where you will locate it, you will be able to decide if green, brown or another color will harmonize best with the surroundings. When the paint is dry, securely fasten the bird-house to a tree or building, being careful not to have the entrance face the prevailing winds. Be sure also that the house is placed out of the cat's reach.

HOW THE SAILOR TIES HIS KNOTS

THERE is usually a time in the life of every boy when he wants to be a sailor. Every boy cannot be a sailor; but one part of a sailor's duties is very interesting, and a knowledge of it is likely to prove useful even to boys and men who are not sailors. That part is the making of knots and hitches and the splicing of ropes. It is easy to learn how to do these things. All that is required is a few pieces of string, a stick or a rod of wood or metal to serve the purpose of what sailors



Simple knot.

call a marlinespike, or a handspike, which is used for some knots, and a little attention.

The first knot is the simple, or overhand, knot, seen in the first picture. We notice in the picture that one end of the rope is marked "standing part," the other end is simply marked "end," and the loop is marked "bight." We must remember these names, as we shall use them frequently in our descriptions of knots. The standing part means the part of the rope not right at the end, but a little way up, and in making a knot we always

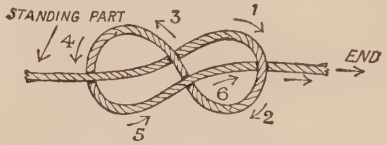
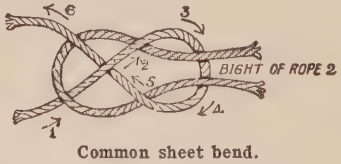


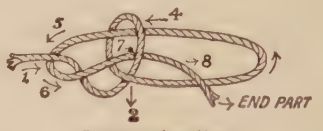
Figure of eight.

bend the end round the standing part. In some knots we use only one end of a rope; in other knots we use two ropes or the two ends of one rope, and in this case there are two ends and two standing parts. Sailors call a coil or a loop in a rope a bight. Also notice that in our illustrations we have small figures where there are arrows. These arrows indicate how the string or rope is threaded to make the knot or hitch; and we must follow the arrows according to the figure beside it—2 coming after 1, 3 after 2, and so on.



Common sheet bend.

The next knot is what is called the "figure of eight," and from its appearance we can see that the name is appropriate. In making it, we pass the end of the rope round the standing part, then over "its own part" and through the bight. We understand what is meant by "the standing part"; and the words

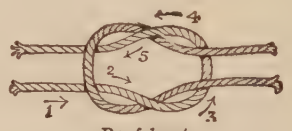


Common bowline.

"its own part" mean the part of the rope or string that we have already bent around.

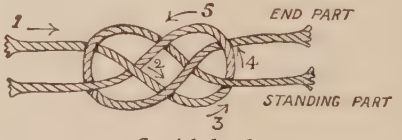
The next knot is what sailors call the common sheet bend. It is made with two ropes or with two ends of the same rope. We form a bight with the first end, and pass the other end through this bight, then right over both parts of the first rope, and then under its own part. By passing the second end under its own part, we jam it against the edge of the bight and prevent its slipping.

The next is called the common bowline,


Reef knot.

and is a little more difficult than any we have yet seen. We must follow the arrows in their proper order very carefully. It is made with one rope or one end. Some little distance from the end of the rope we form a bight with a half-twist, thereby making a loop. We pass the end up through this loop, round the standing part, and down again through the loop.

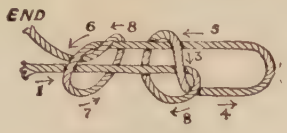
The next, probably the most valuable knot of all, is the reef knot. It is commonly used in joining two ropes or two ends of one rope. We make a bight of the first end with the end and the standing part side by side. Then we pass the other end up through the bight,



Carrick bend.

round both parts of the first end, and down through the bight again. Another way to make it is to pass the first end round the second end, then bring the two ends back to their standing parts, passing one part round the other so that two parts of each rope pass through the bight in the same direction. If we are not very careful, we shall make the ends come out one under and one over the bight, thereby making a granny knot, which is apt to slip.

The next picture shows the Carrick bend, which is also rather complicated. It is made with two ropes or with the two ends of one

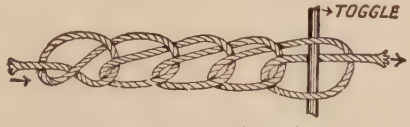


Flemish loop.

rope. We first make a bight of end No. 1, then pass the end of No. 2 through the bight, over the end of No. 1, round the standing part of No. 1, over the standing part of No. 2, and through the bight again, both parts coming out of the bight at different sides. The figures in the picture must be followed carefully in making it.

Now we come to the Flemish loop, which is made with one end only. First we make a common slip knot, and then, with the end, make an overhand knot round the standing part away from the loop.

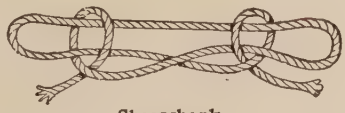
The next illustration is what sailors know as the chain knot and toggle. It is really a number of common slip knots, which many



Chain knot and toggle.

schoolboys know as the drummer's knot, or the rat's tail. The toggle is the bar which is passed through the end loop. The chain knot is made by making a bight on the rope and crossing it. Then we pass a hand through the bight and catch the standing part, which we pull through, forming a loop. We repeat this to make as many loops in the chain as we may think we want. Then we pass the bar, or toggle, through the last loop, and haul on the end to tighten up all the loops.

The next is a sheepshank, in the language of sailors. It is generally used to shorten a rope on which there is a strain. A piece of the middle of the rope is held so as to form

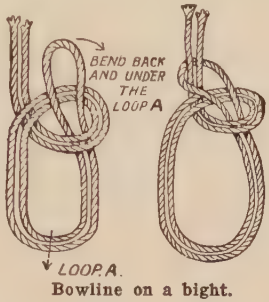


Sheepshank.

three parallel strands, or two bights. Round the end of each bight we make a hitch with the part leading to the end. As long as there is a strain the knots hold securely.

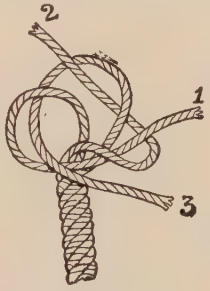
The next is what is properly termed a bowline on a bight; and, to indicate clearly how to make it, there are two pictures, one showing it half made and the other showing it completed. We double the rope, and make a bight with it doubled. Then we pass the doubled end under, and up through the bight, and back over the whole loop, and up to the part above the bight. The picture shows more clearly than words how this is done.

The wall knot is a neat way of finishing off a rope and of preventing it from unlaying, or coming apart. It is made in two stages. We untwist the three strands of which the rope is made for a distance sufficient to give us three cords about 8 inches long. Let us call these strands Nos. 1, 2 and 3. We make



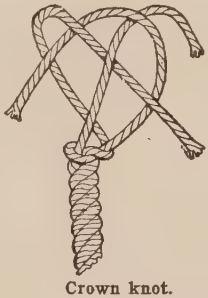
Bowline on a bight.

a bight with strand No. 1 and pass strand No. 2 round the end of it; then we pass strand No. 3 round the end of No. 2 and through the bight of No. 1. Finally we haul



Wall knot.

the ends tight, shaping the knot evenly with the fingers as we do it. The wall knot requires a little practice to do it neatly, but it is not so difficult as it looks.



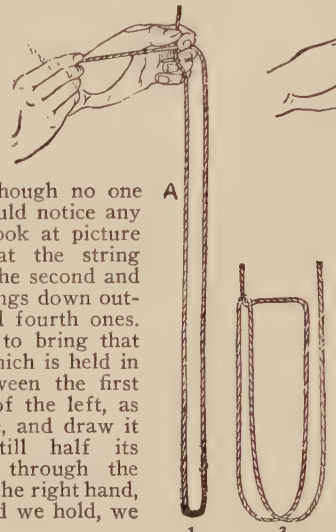
Crown knot.

The crown knot is the wall knot carried a little farther. We make a wall knot as already described, and then take strand No. 1 over the centre of the wall. Now we place strand No. 2 over No. 1, and strand No. 3 over No. 2 and under No. 1. Then we pull them all tight.

CUTTING THE MAGIC STRING

THIS is an old trick, but it is a very good one, and, improved to the form we are about to describe, it is very little known. It can be performed just as well by a girl as by a boy, and it has the great advantage of requiring no previous preparation. When we have once acquired the necessary skill, we can perform it at a moment's notice, all that we need being a pair of scissors and a piece of string.

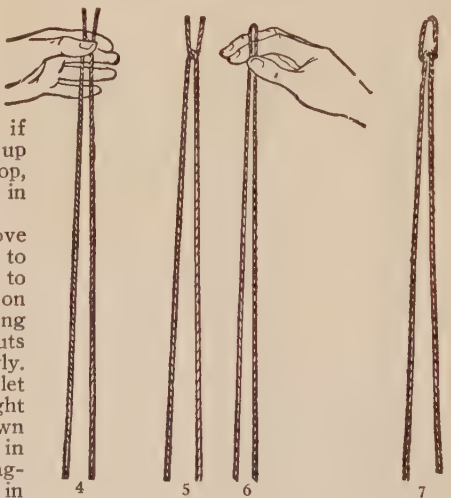
The string should be about 4 feet long. We begin by taking one end of it in each hand between finger and thumb, the rest of the string hanging down between them. But the end in the left hand is not held quite in the same way as the other, though no one not in the secret would notice any difference. If we look at picture 1 we shall see that the string passes out between the second and third fingers, and hangs down outside of the third and fourth ones.



1 3

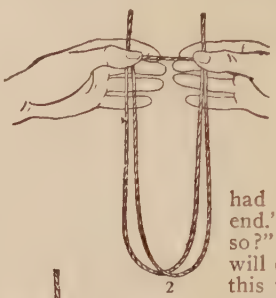
Our next step is to bring that part of the string which is held in the right hand between the first and second fingers of the left, as shown in the picture, and draw it toward ourselves till half its length has passed through the fingers. Then with the right hand, still retaining the end we hold, we make a "grab" at the left-hand string at the point marked A, and bring it up so as to lie level between the hands, as shown in picture 2. To anyone looking on, it seems as if you had merely gathered up the string in a double loop, but it is really as shown in picture 3.

Holding the string as above described, we ask someone to take a pair of scissors and to cut it in halves, the portion between the hands appearing to be the middle, and he cuts at that point accordingly. When he has done so, we let go the string with the right hand, and let it hang down from the left, as shown in picture 4. Everybody imagines that it is fairly cut in half, but the real state of things is as shown in picture 5.


4 5 6 7

The trick of the magic string.

Our next step is to transfer the string to the right hand, not disturbing its arrangement, but taking hold of it a little higher up, so that the upper ends, as well as the point where the two pieces of string cross each other, shall be hidden by the fingers. Asking someone to take hold of one of the long ends, we wind the rest of the string round our own left hand. This draws off the loose bit into the other hand, and when we again unwind the string it is found to be all in one piece, as at first. The little bit remains concealed in the right hand.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But we have not yet finished. Somebody—one of those uncomfortable people who know, or think they know, everything—may very probably say, "Oh yes; I know how *that's* done. The string wasn't really cut in half. You only had a bit cut off one end." "Oh, you think so?" we retort. "Then I will do it over again, and this time you may measure the string before and afterward." If nobody makes such a remark, we volunteer of our own accord to do this. While the string is being measured, we secretly double the bit that remained in the right hand, with the "loop" end upward, keeping it concealed between the fingers and thumb. When the string is handed back after having been measured, we double this also in half, and taking it by the middle between the right-hand fingers and thumb, draw up for an inch or so what is apparently the loop thus formed, but is in reality the little loop made of the short bit. Picture 6 shows how the string now looks, and picture 7 the real state of things. We let someone cut through the loop, and wind the string round the left hand as before. It is again found restored, and when measured will, of course, be found to have lost none of its length.

This is not an easy trick to describe clearly in print, but if we follow the instructions we shall soon learn it.

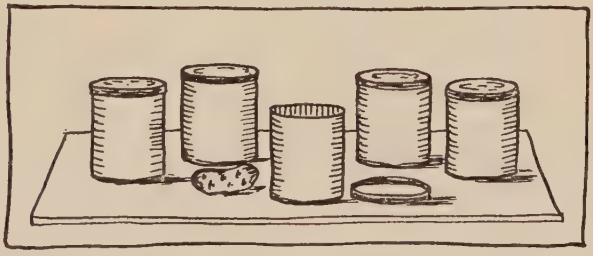
THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 511.

OUR WORTHWHILE GAMES

YOU know apples and oranges and other fruits when you see them at the fruit store. But if your eyes didn't help you, do you think you could tell whether I put an apple or an orange into your hand? Let's see what your fingers can find out about things.

GET five boxes or cans with covers, such as those in which mother gets coffee. Get all five just alike. Play the game first with five things that are pretty easy to guess, such as an apple, an orange, a lemon, a peach, and a pear. Put one of them in each can. Now you are ready to play.

I wonder, do you play alone or are you going to play with one of your friends? You can play either way. If you play alone, put the five boxes in a row. Stand in front of the first one and close your eyes. Open the box. Feel the thing that is inside, and say what you think it is. Then open your eyes. Look and see if you are Just Right. If you are, take it out. Stand in front of the next box and do the same way. When you have been to all the boxes, count how many puzzles your fingers have helped you to guess without any help from your eyes. That is your score in this game.



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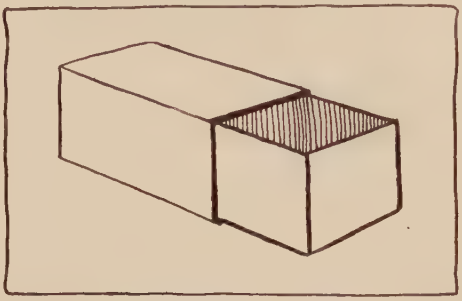
When you can guess all these puzzles just right, try different kinds of things in the cans—vegetables or your smaller toys. You can teach your fingers to find out about many things just by the shape and the way they feel.

SOME people can take things in their hands and tell which are heavy and which are light. If your hands can't help you that much, it is only because you have not yet taught them how. Here is a game about heavy and light. Let's see how well you can play it.



Get some boxes from the druggist. He has some like those in the picture. Get five and five more. They all look alike, so your eyes can't tell which have something heavy inside and which have something light. Put some cotton inside each box so the heavy things won't rattle, or your ears might guess the secret.

Now divide your boxes into two piles. How can you make one pile of boxes heavy and the other pile light? Here is a way. Find some big nails or screws or something metal, because metal is heavy. Put just one in each of the five boxes you are making light. Put five in each of the boxes you are making heavy. Wrap the cotton around them well so they won't rattle or shake. Shut them up tightly in the boxes. Now you are ready to play.

Mix up the boxes so you can't tell which are heavy and which are light. They will all look alike, and they will not shake or rattle. So you have to find out the heavy ones just by weighing them in your hands. Find out the ones you think are heavy by weighing them in your hands. Put the ones you think are *heavy* in a pile. Put the ones you think are *light* in another pile. Then look inside to see if you

are right. If you are puzzled, keep on trying until you can weigh them Just Right. You can make harder weighing games yourself.

CAN you hop like the boy in the picture? Can you hop five times without stopping, hop, hop, hop, hop, hop? Put down marks for each time you hop five times without stopping. How many times did you hop five times without stopping? That is your score. Next time you will make a bigger score. Can you hop as well with the other foot? With both feet together? See how many hopping games you can make.

PERHAPS you can't count well enough to keep score in games. But you can quickly learn. Here is a number game. If you can play it Just Right you can keep score all by yourself.

Cut some cards as big as this. Cut five of them. Then five more. That is ten. On page 1 of your work book you will find pictures of one umbrella and one cap. Carefully cut the pictures apart and put the umbrella on one card and the cap on one card. On the back of each of these cards put a little square of red paper.

Next make the cards for "2." Which of the pictures on page 1 show 2 things? Yes, 2 gloves and 2 shoes. On the back of each of these cards put a square of orange. Next make the "3" cards with green on the back. Then the "4" cards with purple and the "5" cards with yellow. Now you are ready to play.

One game you can play is MATCH MINE. If you play with a

friend, you may put all the cards out where both of you can see the pictures. You take a card. You may say, "I have *five* pennies. Match mine," and he may match with five tops. You can be sure that he has matched the same number even if you can't count very well yet, because you put the same color on the backs of both cards that have the same number.

If he matches Just Right, he gets both the cards. But if he puts down a card that doesn't match you may say, "No that doesn't match. See, here are five tops. These match my five pennies. So I get the cards this time." But the next time he can probably match just as you showed him.

Then it is his turn to choose a card and let you match his. After his turn you will get another turn, then he and then you again. You keep taking turns until all the cards are gone. Whichever one gets the most cards at the end wins the game. I wonder who will win the first game. Each of you will win some of the games, and if you help each other whenever you make a mistake, you will soon match every card Just Right. Then you will make some harder games to play.

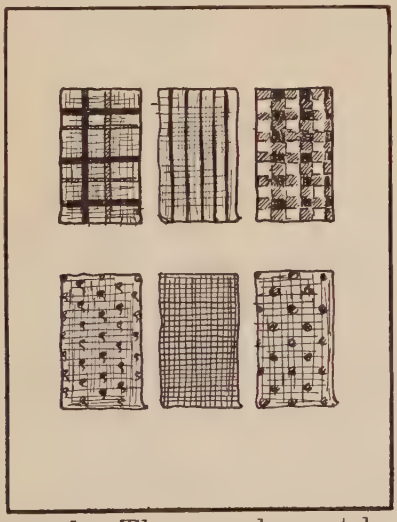
HERE is another matching game. This time you match different kinds of clothing. What is your sweater made of? Yes, wool. Find a piece of an old sweater mother is willing for you to cut. Cut it the shape of a sweater and glue the top of it to a card.* Find all the pieces of wool

*In order that the cloth may be big enough for the child to handle it well, cards about 9 x 12 are good size.

you can—perhaps a piece from an old woolen suit, or a woolen dress, a woolen blanket or a woolen stocking. Cut a little piece of each of these to paste on the back of your woolen sweater card. Put the rest of the piece in your cloth box. You will need them to play the matching game.

What is your play suit made of? Yes, cotton. Find a piece of cotton cloth. Cut it the shape of something you wear that is made of cotton. (Perhaps you wear a cotton play suit or a cotton apron or a blouse.) Paste the top of this on the big card you are making for cotton. Find as many kinds of cotton cloth as you can. Paste a little piece of each on the back of the card and put the rest in your cloth box. You can make a card for silk too, and perhaps one for linen if you like, or any other cloth you want to know about.

There are several ways of playing with these cloths. The first way is a puzzle for the fingers. If you are playing with Joe, he may say, "Close your eyes. Find a piece of cloth in the box, that is woolen like this sweater." You feel each piece until you come to one you think is woolen. Then you open your eyes and say, "This is woolen." Joe will turn over the sweater card, so you can see if there is a sample there of the piece you have in your hand. If there is, you know you are right. Then you take Joe's place as leader, and tell him what to match. The one who matches the most times Just Right wins the game.



HERE is a harder game. Both Joe and you choose a piece of cloth but leave it in the box and say nothing. Then both of you draw a picture of three things that are made out of the cloth. Of course you

don't tell Joe which one you have chosen, and he doesn't tell you which one he has chosen. When you have finished your pictures, you give yours to Joe and he will give his to you. See if you can find the cloth that he chose. See if he can find the cloth that you chose. This is really a thinking puzzle, and of course you can't play it right unless you know the names. But you can learn them in the easier game.

HERE is a still harder game that some children play. Joe says, "Shut your eyes." While you have them shut, he takes a card and puts it behind him. He says, "I will tell you three things about this cloth I have hidden. It is soft. It keeps us warm. It grows on a sheep. Find a piece of it in the box."

If you find a piece of wool, match it to Joe's card. You win that turn. You score two marks. If you can't find the answer to Joe's puzzle, you may feel the sweater cloth on Joe's card—but you won't look—and if you find the cloth now, you may score just one mark. At the end of the game, see who has the most marks. He wins the game.

HERE is a puzzle game for your ears. See if mother has five empty tins that cocoa or baking powder comes in. It's better if all of the tins look alike so your eyes can't help you.

You put something, whatever you like, in each one of the tins and put the cover on. Perhaps you have beans in one, lumps of sugar in another and other things mother has given you a bit of from the pantry. Or perhaps you have a few screws and safety pins and such things in the cans. Different days you can make different puzzles for your ears.

If you and Jane play together, you puzzle her and let her puzzle you. You will each have five puzzles. See who will listen most carefully and get the most turns right. You can tell by looking inside. I hope you get them all JUST RIGHT.

WHAT HAVE YOU LEARNED?

Can you tell what things are just by feeling them? Things you eat, things you play with, things you work with and all sorts of things?

Can you tell which things are heavy and which things are light just by weighing them in your hand?

Can you tell how many are here? ★★★ and here? ★★

and here? ★ and here? ★★★★★ and here? ★★★★

Do you know the names of the different kinds of cloth?

Do you know what the different kinds of cloth are used for?

Can you match woolen with woolen, cotton with cotton, and so on, just by feeling, without looking?

Can you tell the name of each kind of cloth just by feeling it, without looking at it?

Can you make up a puzzle about cloth so the other children can find the kind you mean?

Can you draw a picture of three things made out of some kind of cloth so that the other children can find the cloth?

Can you tell what things are just by hearing the sound they make when you shake them in a can or box?

Can you help the other children learn to do what you can do?

If you can play all of these games and guess all of these puzzles for your hands, your eyes, and your ears, and can even do those hard drawing and thinking puzzles, we will have to make some harder games right away.

NOTE TO PARENTS: You will notice that the different games are not named. With your encouragement, the children will name them with their own special names. Make a note of what the child calls each game and write it in the index page of his work book, with the number of the volume and page where it is described. Always refer to the game by that name.

THE NEXT HELPS TO LEARNING ARE ON PAGE 519.

THE OLDEST STATUE IN THE WORLD

The Sphinx at Gizeh, in Egypt, is carved from one mass of solid natural rock, with the exception of the forepaws, which are built up with blocks of stone. Its date is unknown, but it is probably the oldest statue in the world, and certainly it is the biggest single sculptured figure on earth. It measures over one hundred feet long. It is very impressive and awe-inspiring on account of its stupendous size and its strong outline. The Arabs call the Sphinx "the Father of Terror."

A sea-horse and the heads of two whales as imagined by artists of the long ago.

ANIMALS THAT NEVER WERE

CONTINUED FROM 320

A CLEVER man has been writing about the intelligence of animals, saying that we give them credit for far more sense than they possess. How can we believe the horse to possess much sense, he wants to know, when, after the thousands of years that it has been domesticated, it still shies at a white stone on the road, or runs away and dashes itself to pieces at the sight and sound of a steam engine or motor car?

That seems very hard to answer. When we come to think it over, however, while we cannot but regret that some horses should still do these stupid things, we have to remember that the human race has not always been as wise as it is to-day. We remember that men have believed things which are quite as absurd. The horse is descended from a wild animal which learned that by a sudden rearing and swerving it could avoid the attack of enemies waiting to attack it, so to-day, when taken by surprise, it still shies on the road, because its instinct of fear and desire to avoid danger are not dead. Its instinct overmasters its knowledge.

And exactly the same thing happens in the case of men to-day. Up and down the country we find goats in stables. Why is that? It is because the grooms have a superstition that the goats keep disease away from the horses. Country people often believe that the nightjar robs goats of their milk, and call the bird the goat-sucker. Others believe that harmless little newts are endowed with a deadly poison, think that frogs spit poison, and that toads cause warts. Thousands believe that ill-luck will come if a black cat crosses the road in front of them.

Savages, of course, have the most extraordinary beliefs. Some of them *worship* everything that frightens or puzzles them. In parts of India they worship plague and cholera. One African tribe worshiped the bottles which had contained the medicine that cured them of illness. But the beliefs of savages are not more absurd than the beliefs which our ancestors held, even in days of learning. We can laugh at these beliefs now, but we can also get some instruction out of them. We must not forget that our ancestors believed in magic, and, believing in magic, nothing seemed impossible to their minds. They thought that the toad had a precious stone in its head, and that this stone could cure sickness. Hence so-called toad-stones became common.

Half the animals that never existed were supposed to have magic powers. Thus the unicorn, which figures in the national arms of England, was believed to possess magic in its horn. Men went on long pilgrimages in search of this animal, which was said to roam in India, Arabia and Morocco. No man arrayed as a man could approach

it. He must disguise himself as a young girl, perfume his clothes, and lie down in the haunts of the unicorn. The unicorn, attracted by the scent, would then approach, and charmed with the sweet odor, would lay his head in the supposed maiden's lap and fall asleep. Thereupon the hunter had to grasp the horn, and,

The unicorn as it was supposed to be.

with a single powerful wrench, pull it out! Or, if that were too bold a course for one man, then the disguised hunter lured the unicorn to him, while others lay in hiding and dashed up to seize the coveted horn. Out of the horn a drinking cup could be made. Poisoned wine drunk from it lost its power to harm.

How men of the time managed to impose this story upon their hearers is not for us to decide. They were bold enough to tell the tale and actually to produce what they called the "horn of the unicorn." A writer of the time of Queen Elizabeth mentioned one which he saw at the queen's court. It was worth £10,000, he said, and in our time would be about $250,000. What really was this unicorn's horn? It was the spiral horn, or tusk, of our old friend the narwhal! The rhinoceros was supposed to possess something of the qualities of the unicorn, and brave Marco Polo the traveler said that it did no harm with its horn, but with a fearful tongue, all covered with prickles, it rasped the flesh off its victim's bones!

How did men get their idea of winged dragons? There really were, once upon a time, creatures in some ways resembling the things which the frightened imaginations of men pictured. But they belonged to the age of great reptiles, and there were no men alive to know of them. The fact that these creatures had existed was not known to the world until long after men had ceased to believe in dragons. The real dragons did not breathe fire, nor had they for parents the eagle and the wolf, as our ancestors believed. There were no eagles or wolves when the real dragons walked the earth or flew in the upper air. All sorts of terrors were supposed to result from the dragons. As the unicorn and the rhinoceros were said to free the waters from the poison of the dragons, we have another reason why these animals were held in such respect.

But our ancestors did not waste all their fright over the dragons; they believed that the basilisk was a brute still more to be feared. This reptile, which was considered the king of its order, was supposed to be hatched by a serpent from the egg of a cockerel, and the cockerel was the only creature of which it was afraid. A glance of the basilisk's terrible eye was said to kill a man, while the creature was supposed to be so charged with poison that it infected the air, so that all living things, plants, herbs, beasts and birds fell dead wherever it went. We can guess for ourselves what this frightful monster really was. It was a lizard living upon little insects and small creatures frequenting the water and foliage in which it lived.

An imaginary flying-dragon.

That gives us an idea of the power which our ancestors had of frightening themselves over innocent animals. They believed that there were creatures called satyrs, which had the head, horns, legs and feet of goats and the bodies of men. Then there were all manner of dreadful stories of hairy men with tails, which we know now were distorted accounts of the great apes. Every child to-day is familiar with the idea of the sphinx; but when we speak of the sphinx we think of that great image in the sands of Egypt.

In the old days, however, the sphinx was a thing of real terror to man. They thought of it as an actual living creature—an animal with a human head and face, the body of a lion, the wings of a giant bird, and the tail of a dragon. But the griffin was still more to be feared. This was a creature which had the head and neck of an eagle a hundred times enlarged, and the body of a lion eight times as big as that of an ordinary lion. His talons were said to be as long as the horns of an ox, while his bones were so great that his ribs made bows for the stoutest warriors. No wonder, if this monster was believed in in Europe, that the Eastern peoples believed in the giant bird, the roc, which was said to fly away with characters in the well-known Arabian Nights. Then we must not forget the phœnix. This was a marvelous bird, sacred to the sun. It was as big as an eagle, with brilliant golden plumage round the neck, while the rest of the body was a purple color. The tail was composed of long and brilliantly colored feathers. Here, undoubtedly, we have the golden pheasant, which we may see any day at the zoo. It is not as big as an eagle; it does not rise alive from its own dead body; it does not live 540 years—all of which was believed. But it otherwise answers the description which the old naturalists gave it. Probably some one of them *did* see a golden pheasant, then very rare in Europe, and had to weave a tale of marvel and magic and mystery round it.

The gorgon as our ancestors imagined it.

An imaginary sea-bishop.

They invented marvelous stories about the fox, the wolf, the lion, and so forth. Men were supposed to be turned into wolves, and these "wolves" were supposed to be far more fierce than the ordinary beast of prey. Natives in India still believe that men are turned into tigers, and the natives of Australia imagine that they themselves are inhabited by the spirit of an animal, or a tree, or a plant. Much the same sort of ideas are to be found among the savages of Africa. Many of the beliefs which our fathers in Europe held in the Middle Ages were much like those of the savage people of the world to-day.

A dragon that many Chinese believe in.

How firmly the old beliefs were held we may know from expressions used to-day. We still speak of a movement which has seen evil days, and comes again to prosperity, as "rising, phœnix-like, from its ashes." We still speak of persons who like the heat of the fire as "salamanders," because the salamander was believed to be able to live in the fire. We still use the word "gorgon" as a term of terror and horror. The ancients had their gorgons, monsters whose heads were clad with serpents instead of hair. But

our later ancestors had a gorgon of quite another kind. *Their* gorgon was a fearful creature living in Africa. It had the body of a giant armadillo, with a serpent-like tail, and the legs and feet of a pig, but it was all armed with great scales.

An old picture of sailors encamped on the back of a whale.

The head was like an ox's, covered with coarse hair. But the eyes and the breath were the thing. Men were not quite sure which did the damage; one or the other sent forth poison which instantly killed men or animals who might attack or even approach the gorgon.

Even a child can laugh to-day at the ridiculous things which frightened the wits out of our greatest scholars and philosophers of old time. We might not be so amused if our ancestors had merely believed in these things, as silly people in our own day believe in ghosts and witches; but they wrote solemn books describing terrible adventures with these imaginary creatures. The list of impossible things in which people believed in these ages is almost endless. There was a certain sort of lamb which grew on a tree. Men drew pictures of the "vegetable lamb of Tartary." They were trying to tell of the cotton plant. There was a tree which grew out of the sea from the timber of wrecked ships and produced geese. There was a frightful thing called the chimera, an awful creature with three heads—those of a lion, a goat and a dragon. There were fabulous creatures called harpies and sirens which drew seamen to destruction. The harpy had a woman's face and body, but the talons of an eagle. The siren we know to-day is a terrible screeching thing used by motorists to wake sleepy drivers on the road, or by steamers at sea in a fog; but the sirens of old time were supposed to have lovely voices, which drew navigators from their course at sea and lured them on to rocks.

We need not be surprised that the sea gave our ancestors good scope for nightmare stories in which they could all believe. Even to this day, the vast mysterious ocean has a fascination and terror. We all know the sea-lion, which is simply a big seal. But it used to be considered a monster of the deep like a real lion, clad in mail. The idea must have come from some observer's noticing that this seal, when dry, shows a good mane, giving it rather a lion-like look.

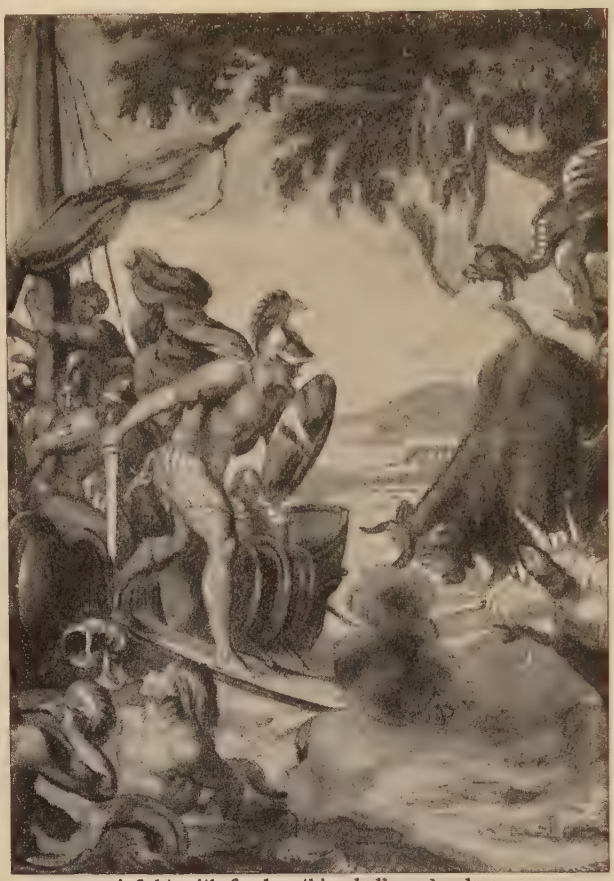
Then somebody would argue from this description that the sea really had a lion, and would add the coat of mail as an ornament to his story. We have also the sea-elephant, a huge, funny-looking seal, with a snout something like a small elephant's trunk. Long ago men wrote about a sea-elephant, and drew pictures of it, making it appear that the animal had the head, trunk, tusks and front legs of an elephant, the hind quarters being simply the body of a fish.

An old picture of a sea-serpent attacking a ship.

The size and strength of the whale

ST. GEORGE'S FIGHT WITH THE DRAGON

The fight of St. George is supposed to represent the triumph of Christianity over paganism. People once believed that a fight with a real dragon actually took place.



A fight with fire-breathing bulls and a dragon.

should be enough to satisfy anybody, but it was not enough for our ancestors. They described it as being about 960 feet long and 480 feet broad. The teeth were said to be 12 feet in length, and the eyes were so big that twenty men could sit in the space of one!

The whale was said to have two horns, or tubes, through which it sent great columns of water that would sink any ship. Then the whale was declared to rise above the clouds and, descending upon the ship, sink it. Further, its head was armed with a great number of prickly horns. We can see here, through the exaggeration, that someone had tried to describe a toothed whale, but the idea of the horns about the head had arisen from the plates of baleen in the mouth of the whalebone whale. This monster was said to come up to the surface of the water, bearing quantities of sand upon its back. Sailors would approach in their ships, and, mistaking it for an island, would cast anchor in its back, land, and make a fire on it to cook their meals, until the whale, feeling the heat, would dart down into the sea, carrying men and ship.

There remains the kraken to describe. Now, the kraken was the most terrible of sea-beasts. There were supposed to be sea-bishops and sea-monks who did all sorts of alarming things for the terrifying of unhappy mariners, but the kraken was the worst of all. It was a creature whose back measured a mile and a half in circumference, so that, as it floated on the crest of the waves, sailors mistook it, as they mistook the whale, for an island. But the kraken had arms like the tallest masts of ships, and with these it could seize the greatest vessel and pull it down beneath the waves. When the kraken sank, it was supposed to create such a whirlpool that all ships near were sucked under, and their crews drowned. It was a Norwegian bishop who first spread the story of this monster. There can be no doubt that he really did see a very large cuttle-fish. Nobody knows how big the biggest of these really is, but we know that its body is nothing like what the frightened bishop thought he saw, nor are its arms capable of upsetting a ship. The stories of the kraken grew rapidly, but they became mixed up with stories of the sea-serpent, of which the most fanciful tales were told. Probably there were sea-serpents once, and it is just possible that they yet exist in the great depths of the sea, but, so far, no story has managed to stand unshaken. Ribbon-fishes have been mistaken for sea-serpents, a line of whales or of dolphins with peculiarly shaped backs has had the same effect, and many other curious sights have misled men into telling the same old story.

Then there were the mermaids and the mermen, and to-day many people believe still that these creatures actually exist.

Poets have helped to keep the belief alive, and Matthew Arnold wrote a lovely poem on the subject. The mermaids were supposed to be beautiful women having the tail of a fish, and the mermen were the male members of the family. The mermaids and their lords and lovers are only manatees and dugongs, or sea-cows. All the mermaids of our poems and stories are lovely in feature, but the animals themselves are rather hideous, and dull, stupid things, too. They are about ten feet long, with curious fleshy muzzles ending in a sort of disk. The great virtue of the mother manatee or dugong is her love for her little one. She tends it with all the care and affection possible. When she feeds it, she raises herself in the water, clasps the little one to her, holding it with one flipper, while she swims with the other flipper. Thus, at a distance, a sailor might imagine the pair to be a mother and her child in the water. The legend as to the streaming hair could scarcely come from the bristles with which her head and face are surrounded. The manatees and dugongs live on seaweed, and no doubt observers thought that this seaweed was mermaid's hair. One kind of merman was called a sea-bishop, because it was supposed to have a mitre-shaped head.

The list of absurd things in which our forefathers believed is not nearly exhausted, but those at which we have glanced help us to understand the strange world of thought and fancy in which they lived. We are not so far above our ancestors in some ways as we often imagine. Even now, in many a village, and in some big towns too, deep ignorance prevails.

There are many superstitions about snakes. Some people believe that hairs from the mane or tail of a horse placed in stagnant water will turn into slender snakes. It is believed that a certain snake steals milk from cows. You may have heard of the "hoop-snake," which takes its tail in its mouth and rolls along the path, or the "glass snake," which can be broken into pieces, but if left alone will come together again. There is a little truth in this. There is a lizard without legs which looks like a snake, but when the tail breaks off it must grow another. Oil from the fat of snakes is supposed to be good for rheumatism.

The "left hind foot of a graveyard rabbit" carried in the pocket is supposed to bring good luck. On the other hand, if dogs howl around a house in which there is sickness, the sick person will die. The hooting of an owl at midnight also foretells calamity to the house.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 493.

Hercules slaying the many-headed hydra.

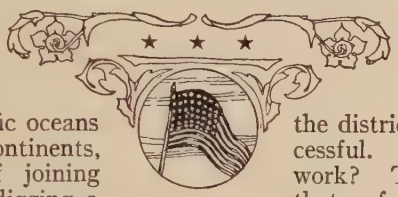
CUTTING THE NEW WORLD IN TWO

This picture shows how the canal locks. It was begun in 1881 by De Lesseps, the celebrated builder of the Suez Canal, but had to be abandoned after $350,000,000 had been wasted. The United States took over the work in 1903. In 1907 Colonel George W. Goethals was placed in charge. This great man put a huge army of men to work, and the big task of cutting the New World in two was completed, so that on August 13, 1914, the steamer Cristobal made a trial trip and two days later the Ancon opened the canal to the world by carrying its passengers and cargo to Balboa on the Pacific side. Now a number of great ships pass through every day, particularly tankers carrying oil from the California oil-fields. A great exposition at San Francisco, to celebrate the completion of the canal, was opened on February 20, 1915, by President Wilson pressing a button at Washington and sending a message by wireless.

WHAT THIS STORY TELLS US

FOR four hundred years the idea of a canal across the narrow isthmus joining North and South America had captivated the imagination of men. The work seemed so difficult and so expensive, however, that no one tried it for many years. When the Suez Canal was completed, Ferdinand de Lesseps, who had planned and managed that work, determined to join the Atlantic and the Pacific. He failed, purely and simply because of poor and mal-administration, and finally the United States undertook the work. This story tells how disease was conquered first, and then how, by the aid of brains and machinery, the immense task of digging the canal was accomplished. Now ships easily pass from ocean to ocean, climbing eighty-five feet above the sea by means of locks, and then descending again. Our pictures will give you an idea of the difficulty of the work and of the appearance of the canal and the locks.

DIGGING THE PANAMA CANAL



EVER since explorers found that only a few miles of land separated the Atlantic and Pacific oceans between the two continents, men have spoken of joining these two oceans by digging a canal. It was evidently so expensive and so difficult that no real attempt was made until the year 1878, when a French company secured from the Republic of Colombia the right to dig a canal through the Isthmus of Panama. At the head of the company was Ferdinand de Lesseps, who had succeeded in separating Africa from Asia by means of the Suez Canal, and spurred on by his success in this great work, felt sure that he could accomplish this task on the other side of the world quite as easily.

It was found, however, that the two pieces of work could not be compared. The Suez Canal is only a great ditch through the land or through shallow lakes. While the weather is hot, the climate is not particularly unhealthful for Europeans, and workmen could be secured from the neighboring peoples.

In Panama tropical conditions prevail. During the rainy season vegetation grows up almost in a night, and drainage is difficult. Moreover, it used to be unhealthful, and many men engaged on the work died.

Mountains had to be dug through. The attempt to get the inhabitants of the district to work was unsuccessful. Why should they work? The soil was so rich that a few hours' work in the course of a month would furnish abundant food, and therefore they could see no reason why they should work, hour after hour, in the rain or the sun, carrying away soil, blasting the rock, and doing the other hard tasks which are necessary to be done in cutting a canal.

At first it had been announced that $127,000,000 would be sufficient to do the work; then the larger sum of $180,000,000 was called for, and finally it was seen that this latter sum would not begin to see the work completed. Though Monsieur de Lesseps' plans were good, and though much of the work done was well done, some bad men got control of the company, much money was stolen and the company was thrown into debt. Finally De Lesseps was arrested, though it seems that he himself had not been guilty of dishonesty. The French people would not put any more money into the canal, and so for several years the whole plant lay idle. The houses of the canal workmen were hidden in vines in the undergrowth which sprang up. It

seemed that all traces of the French attempt were to be wiped out.

Meanwhile in the United States there was interest in the canal, and this interest grew as the western states developed. Some men wished to buy out the French company and continue the work across the Isthmus of Panama. Others preferred to cross the Isthmus of Nicaragua, farther to the north. Here the distance between the Atlantic and Pacific was much wider, but it was expected to make a large lake and a river part of the canal.

DIFFERENT TYPES OF CANAL AND DIFFERENT ROUTES SUGGESTED

Another marvelous project was to cross the Isthmus by means of a ship railway. An immense frame, or cradle, capable of receiving the largest ship was to be constructed. This was to be mounted upon many-wheeled trucks running upon several railway tracks. These tracks on each side of the Isthmus were to extend into the sea. The cradle would be pushed out into the water, the ship was to sail in, and the powerful engines would then draw the trucks out upon the land and carry the ship over to the other side of the Isthmus, where it would be lowered into the sea.

Finally, after much discussion, the Panama route was chosen, the French company was bought out for $40,000,000, and the United States was ready to begin. Just then the Republic of Colombia seemed to intend to go back upon the bargain it had made and to charge the United States a much higher price than had been agreed upon for the right to cut the Isthmus. The citizens of the Isthmus were unwilling to see so much money lost, and they therefore suddenly declared themselves independent of Colombia in 1903, and created the Republic of Panama. An agreement was immediately made with the new republic. The United States agreed to pay $10,000,000, and, after ten years, $250,000 a year.

THE LOCK CANAL IS DECIDED UPON

The building of a sea-level canal was at first mentioned, but soon, though less than half of the committee which had charge of the work reported in favor of a lock canal, it was decided to build the latter type, that is to say, a canal which is not level all the way across but one in which the boats are raised by means of locks as explained on page 4785. The Republic of Panama granted to the United States a strip of land five miles wide on each side of the canal. This is called the Canal Zone. Also the privilege of controlling the health conditions of the cities of Colon and Panama was granted. At first civilian engineers were appointed, but in 1907 the entire work was placed in charge of Colonel George W. Goethals, U. S. A.

Now let us see what has been done. We will imagine ourselves on board a ship in Limon Bay at the port of Colon on the Atlantic side. The map on page 360 lies open before us. "Terminal facilities," or conveniences for ships, such as safe harbors, docks, repair shops, cranes, storehouses and fuel plants were all included in the canal construction, and those at Colon and Balboa to-day are marvels of convenience. Because of the strong "Northers," or periodic storms sweeping in from the Caribbean, two breakwaters have been built across the bay to protect ships at anchorage. At the Pacific end, freedom from storms makes this protection unnecessary, but there, as cross-currents brought silt into the dredged channel, a breakwater consisting of a soil dike was built from the mainland to Neos Island. The soil for this dike was brought from the great Culebra Cut.

THE ACTUAL CANAL AND THE GATUN LOCKS

After reaching the sheltered water behind the breakwaters in Limon Bay our ship follows a dredged but invisible channel to a place where with low jungle-clad banks the canal visibly begins. Steaming slowly now, we proceed in a sea-level channel five hundred feet wide toward the great Gatun locks seven miles inland. Dense, brilliantly green jungle begins at the water's edge; overhead black buzzards hang against the blue sky, queer pelicans solemnly bestride every post in the channel, and slim herons, gray-green or blue, are fishing industriously.

As we approach Gatun locks a huge arrow on the end of the central wall between the two tiers of chambers swings to the right and our ship slips slowly and gently into the right-hand chamber. From close quarters we can hang over the ship's side and get our impressions of the great engineering feat which is going to lift us and our thousands-of-ton ship eighty-five feet to the lake above. We can hear that our engines have stopped, and see that

WASTE WATER FLOWING OVER THE SPILLWAY, GATUN DAM

To avoid the great rise caused by tropical rains in the Chagres River it was dammed and an artificial lake thus formed. The Gatun Dam is a mile and a half long, and a third of a mile thick at the bottom. A core of stone was made, clay was forced in between the stones, and then thousands upon thousands of loads of earth were dumped upon it. In the centre of the valley was a small hill, and here the dam is of concrete, with fourteen large gates near the top. This is called the spillway. When the water in Gatun Lake becomes more than eighty-five feet deep, some of the gates are opened, and the waste water rushes out with tremendous force.

little electric locomotives are being fastened by gangs of colored men to our bow, centre and stern on both sides. The locks are in three steps, or flights; they are also double-chambered, and another ship is being put through at the same time as ours. Now the "mules," or locomotives, are harnessed, a great gate swings to behind us and the water boils up from a score of invisible openings operated by an invisible power hidden in the great stone walls and raising our ship to a new level. The gate ahead of us opens and we are towed into a second chamber; again the water rises; we pass into a third chamber and the process is repeated. The last gate opens and we emerge at last and look down and back to the canal eighty-five feet below.

GATUN LAKE FORMED BY DAMMING THE CHAGRES RIVER

We are in Gatun Lake now: to the right a long green mound stretches away to the hills, in its centre a stone part with gates. The mound is the great dam which at the Atlantic end confines the waters of the Chagres River, forming the great artificial Gatun Lake which has an area of more than 150 square miles. On the Pacific side the dam is made by the Pedro Miguel locks. Tropical rains cause a great rise in the rivers in Central America, and the only way to overcome this difficulty with the Chagres (which sometimes rises twenty-five feet in twenty-four hours) was to allow it to form into a great lake, beneath whose waters lie the sites of villages, construction camps and the former right-of-way of the Panama railroad. This lake in the dry season now serves as a reservoir from which to supply the water needed in the canal and locks, and also for the electric plant which generates the power used in the Zone.

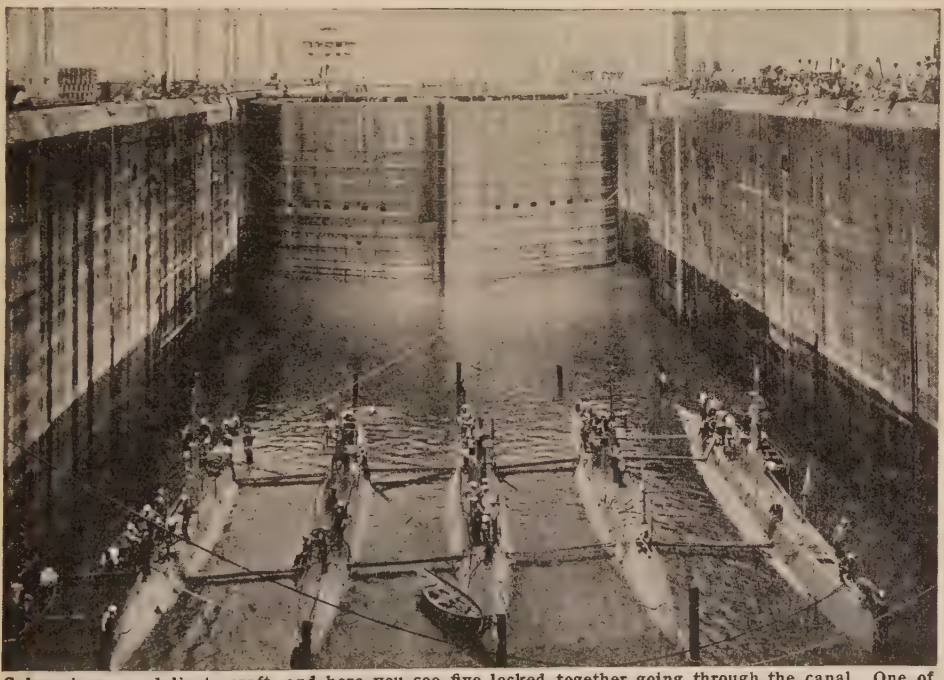
As far as we can see, water stretches on every side—the only sign that it has not been there forever the tops of innumerable dead trees festooned with ferns and orchids. Here and there hill-tops emerge as small islands and form natural asylums for the birds and game that once inhabited the now drowned jungle. Our ship steams quickly on for thirty-two miles; here the channel is a thousand feet wide and the banks far off. Then we enter a waterway so straight and narrow that we could have no doubt that we are in the canal itself. At the Atlantic end the hills were distant and blue, now they are close upon us, not in regular formation, but as single queer green bumps rising from the plain and inclosing wide valleys. We reduce our speed to avoid washing the banks as we approach the great Gaillard Cut, usually called the Culebra Cut. It is the deepest in the canal, with a depth of 495 feet cut sheer through great hills. It is difficult as we steam slowly past the vividly colored cliffs to believe that the cut is not natural but the work of great "earth-gobbling" monsters, who, following in the wake of sticks of dynamite, scooped up the hills in great mouthfuls and dropped them into waiting cars to be dumped elsewhere. It is not possible to build concrete supports for these carved hillsides, for there is no rock foundation to build upon. The hills here are of curious formation, loosely packed shale which crumbles when exposed to the air. Time and time again has this loosely packed soil caused trouble. Sometimes the surface has slid right down over hard-packed rock and choked the canal with tons of soil. Sometimes the slides have gone only part way down and added weight to the bank of the canal so that the bottom has bulged upward like a dome. Giant dredges are ever at work in the channel, and now slides are lessening all the time; on the hillsides above workmen play powerful streams of water, as in placer mining, to wash material down to be dredged away, in order that the weight of rock may be reduced and the balance which the excavation disturbed restored. Then all will be smooth sailing.

PEDRO MIGUEL LOCKS, MIRAFLORES LAKE AND LOCKS

A swing round another curve (no one must imagine that the canal runs straight) and we enter Pedro Miguel locks, which, in single flight only, drop our ship thirty feet down to the lower level of the Miraflores Lake. On the Atlantic side the difference of level is overcome by three pairs of locks in continuous flight; on the Pacific, adequate rock foundation could not be found for all three steps, so one pair is at Pedro Miguel and two others at Miraflores, a mile and a half away. When we have accomplished the descent of the last lock at Miraflores (fifty feet) our ship is on sea-level once more, and proceeds for seven miles to the Pacific terminal at Balboa, the port for Panama City and Ancon. Here are the chief administrative offices of the Zone, and commercial activities are less important than at Colon,

INSIDE THE LOCKS WITH THE SHIPS

Here you see a ship in one of the chambers of the great Gatun locks. The electric locomotives seen on the banks on both sides hold the ship steady, now drawing it along, and now holding back. Water is pumped in till it is level with the step above. Then the gates open, the ship is drawn forward and the gates closed. The process will be repeated three times before the ship has climbed to Gatun Lake.



Submarines are delicate craft, and here you see five locked together going through the canal. One of the reasons why the canal was built was to provide a quicker and easier way for the warships of the United States to pass from one ocean to the other. The ship shown above is the Severn, which is the "mother ship" for the submarines. This means that it carries supplies and a workshop.

although there are fueling plants and large dry-docks.

In 1855 a railroad was constructed across the Isthmus, and this road is now owned by the Government. The change in the plan of the canal route put a large part of the tracks under water, and therefore a new line was laid out. Much of the material taken from the great cuts was used to make embankments for this road. When enough material had been dumped in any one place, by a very ingenious contrivance the whole railroad was lifted and moved several feet to the right or left as the case might be. Of course this work was slow, and the track was not very smooth at first. There were dozens of these temporary railroad tracks along the canal occupying one position one day and another a week later. Today the road is beautifully smooth and the working of traffic—passenger and freight—runs on regular schedule.

The most stubborn part of the cut through Culebra Mountain was the Cucaracha slide. Here the side of the hill slid down into the canal after water had been admitted, entirely filling it. Some of the material was pumped out by dredges and the remainder was taken out by steam shovels. The struggle with the slides caused the death of Colonel Gaillard, the engineer in charge of this part of the work.

SANITATION AND ORGANIZATION THE GREATEST FACTORS

Though the actual work in digging the canal was wonderful, far surpassing anything that has ever been accomplished before in the history of mankind, the work of the Government in making the Isthmus healthful and in taking care of its army of laborers was even more surprising. Years ago both Panama and Colon were subject to yellow fever, which at times almost paralyzed business. Since it has been discovered that yellow fever is always caused by the bite of a particular kind of mosquito, the Government engineers had a basis upon which to work. The sanitary force, under Dr. W. C. Gorgas, installed a system of sewerage in the two cities, caused the streets to be paved, and prevented the collection of heaps of garbage and stagnant water in which mosquitoes might breed. They kept the undergrowth cut down along the canal and sprayed the ditches with crude oil, thus killing the young mosquitoes. As a result, yellow fever has become almost unknown. Before any actual work was done upon the canal nearly two and a half years were spent in making the region healthful.

THE HOUSING AND FEEDING OF THE CANAL FORCE

Over two thousand buildings were constructed, including offices, hospitals, hotels, kitchens, shops and barracks. Many of the buildings left by the French company were repaired and made of use. It was decided, in order to be sure that the men should have a supply of well cooked

and suitable food, that the Government must undertake the work. Good wages were paid to the laborers, and they were furnished with excellent meals at low prices. Provision was also made for the men who occupied more responsible positions. They were encouraged to bring out their families. The single men lived in barracks or cottages and boarded at the hotels under Government supervision. The married men were furnished with quarters and had the privilege of buying direct from the Commissary Department. This Commissary Department was very important and controlled several important manufacturing plants. It was in reality a great department store. It controlled an ice-plant which turned out about 90 tons of ice a day. It baked 14,000 loaves of bread, made 250 gallons of ice cream, roasted 1,000 pounds of coffee and was able to take care of 7,500 pieces of laundry a day. Refrigerator cars ran from its cold-storage warehouses to different parts of the Zone, and every morning the supply train left the central point, depositing such goods as were wanted at the local commissary stations, where the employees and hotels made their purchases. Excellent hospital accommodations were provided at Ancon and Colon.

In the messes arranged for the men the division was by the coin in which the men were paid. One set of accommodations was provided for those on the "gold roll" and another for those on the "silver roll." Generally Americans and Europeans were on the gold roll and the West Indians and the residents of the Zone on the silver roll. This distinction was used to avoid stressing the color line. The meals of those on the silver roll were charged for at one price, and those on the gold roll at another. In most of the mess halls for the gold-roll employees there were two dining-rooms, in one of which the employees might eat without their coats.

THE CANAL A GOOD INVESTMENT FINANCIALLY AND COMMERCIALLY

It is estimated that the canal has cost almost $400,000,000. Such a sum staggers one. But to-day the work could not have been done for double the money. In 1923 profits began to indicate that some day a reasonable interest might be paid on the capital invested. The average time for filling and emptying a lock chamber is fifteen minutes, but it takes between five and eight hours to pass a ship through the entire length of the canal. Nearly four thousand ships passed through in 1923, for the canal is so brilliantly lighted that ships can pass through by night as well as by day. The tolls charged are according to the tonnage of the ship. With the development of the Californian oil-fields the number of tankers using the canal has been greatly increased.

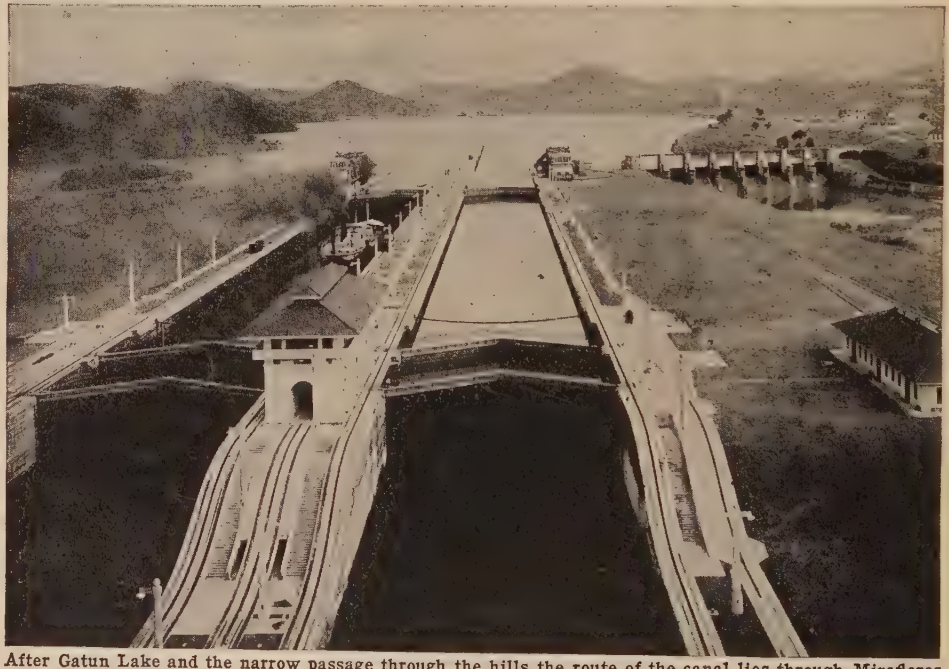
But it was not for direct profit alone that the United States determined to build the canal. Her ships are at a great disadvantage in trading with Asiatic countries, since the chief seaports are upon the eastern coast, and in order to reach these Eastern markets a ship must first sail across the Atlantic and through the Suez Canal, or else go altogether around South America. Then, too, in case of war it would be of great advantage to be able to transfer the navy from one ocean to the other quickly.

The first boat to go through any lock on the canal was the little tugboat Gatun, which was lifted through the three Gatun locks on September 26, 1913. This was a great day for all engaged in the work, for it showed that the end of their labors was at last in sight. Soon larger ships went through. It is a difficult thing to appreciate the largeness of the task accomplished when one sees the finished canal to-day: the actual passage through goes with such smoothness and with the precision of a good watch. Jungle has covered the scars of ravaged forests and hillsides. Tropical rains and sun have sown green links and flowering hedges beside the locks, and decorated the military-looking buildings and streets of Panama and Colon with gorgeous creepers and stately palms. Everywhere there is order, cleanliness, beauty. Yet, if to-day we would truly value the achievements wrought in the Zone, we should keep ever fresh in our hearts and minds how gallantly the forces of death were faced and conquered, the difficulties of construction overcome, and the equipment, provisioning and housing of an "army in the field"—far from its base and in a strange land—organized by the indomitable men sent by the Government. The names of Goethals, Gorgas, Gaillard and Sibert will be added to the rôle of those who have valiantly served their country, and more than their own country—the whole world.

THE NEXT STORY OF THE UNITED STATES IS IN VOLUME 2.

PEDRO MIGUEL AND MIRAFLORES LOCKS

The eighty-five foot level of Gatun Lake is obtained on the Atlantic side by a great dam across the valley of the Chagres. On the Pacific side the lake is confined by a lesser dam between the hills at Pedro Miguel, where, by a single step of thirty feet, descent is made to a small lake called Miraflores.



After Gatun Lake and the narrow passage through the hills the route of the canal lies through Miraflores Lake, a small body of water held up by dams at Miraflores, where the final descent to ocean-level is made by double locks that overcome the fifty-five feet remaining difference in level. From here to the Pacific all is plain sailing. Though the tidal range is great, freedom from storms makes unnecessary the protection of anchorage grounds and canal entrance by breakwaters. Photos, Ewing Galloway, N. Y.

WATER FRONT & DOCKS, PANAMA CITY & BALBOA

Arriving at the Pacific end of the canal, one is confused at first because of the threefold towns grouped together: Balboa, which is the port proper; Ancon, where are the chief administrative offices of the American Zone; and Panama City, capital of Panama. Both photos, De Cou. © Ewing Galloway, N. Y.

At Balboa there are big repair shops and two dry docks, a coaling station and a fuel-oil station, as well as wharves and piers. Some of the features of the port terminals of the canal were designed by Admiral Rousseau.

THE BEAUTIFUL OLD CITY OF PANAMA

Where natural obstacles to communication have been overcome, a great variety of races gather together from all quarters of the globe. This is true of Panama, as it is of Port Said, and its streets filled with Spaniards, native Panamanians, Chinese, East and West Indians are singularly colorful. Panama City was founded in 1519 by Davila, being the first town founded by Europeans in America.

During the seventeenth and eighteenth centuries Panama was the chief port for the Spanish trade in the Pacific. In 1671 it was destroyed by a daring English buccaneer, Henry Morgan, and was rebuilt on a new site about five miles west of the original one. Though its streets are narrow, the city is well built; and after the work on the canal was begun, Panama was given modern sewerage, water works and paved streets. Many of its buildings of Spanish origin are very beautiful. Photos, De Cou. © Ewing Galloway.

Plowing land for wheat.

THE WORLD'S BREAD & BUTTER

CONTINUED FROM 265

ONCE, when the people of France had long been badly governed by selfish kings, it was reported at the court that the people were dying for want of bread. "Dear me, how stupid of them!" said a great lady. "How very stupid of them! Why don't they eat cake?" That showed her to be as stupid as she thought the people were. If they had had flour with which to make cake, could they not have made bread, which is cheaper and more necessary for food?

All civilized people need bread. It is the commonest food; it is the cheapest—but it is the one food which rich and poor alike must have. We tire of almost every sort of food except bread and butter. We grow tired of cakes and cookies and pastry, but not of bread. When travelers return to civilization after long journeys in wild countries, where, if they get bread at all, it is of very poor quality, the thing they are most glad to have is good white home-made bread.

All breads may be divided into two great classes — leavened and unleavened. Leavened means "raised," and so leavened bread is made from dough which contains yeast, baking powder or some other substance which causes the dough to increase in bulk. Bread made in this way is lighter and more porous than the unleavened bread, which is not raised, but makes a harder, drier and flatter cake.

Many grains are used for bread. When people can afford it, they generally prefer wheat, but many other grains are eaten. Corn, rye, oats, millet, barley, durra and rice are all ground up and used for making bread. These are all cereals. Buckwheat is not a cereal, but is much used in America and in some countries of Europe.

These grains differ very much. Only rye and wheat will make a real loaf. This is because of the quantity of gluten they contain. This substance is the sticky part of the flour, and keeps the gas which the leaven produces from escaping. This is why bread made from these grains is lighter than that made from anything else.

You know how dough is made. Flour, water and salt are mixed together in the proper proportions, and yeast is then added. The yeast plants multiply and attack the starch of the flour. Carbon dioxid is set free, and as it cannot escape, forms little bubbles through the dough. Then the dough is kneaded so that every part will be uniform and no large holes will be left. When the bread is baked, it is light and porous.

All wheats are not alike. Some make much better bread than others, because of the quantity and the quality of the gluten, as we tell you in our story of the cereals in Volume Five. The Prairie Provinces of Canada and the states of the United States south of them are said by many to produce the best wheat for bread-making in the world.

THE FIVE SKINS ON A GRAIN OF WHEAT

The wheat grain has five separate coverings, or skins. Most of these are taken out in the mill, and the germ of the wheat also. This takes away some of the food value of the grain. Sometimes all, or nearly all, of these are left in, and we have whole-wheat flour, containing the whole food value of the wheat. Some people like whole-wheat bread, but it does not agree with others. Whole-wheat flour does not keep so well as white flour because of the oil in the germ. It is not so attractive to look at, and does not make a light loaf. This is because the hard particles of the outer covering called bran prevent the particles of the dough from clinging closely together and some of the carbon dioxid escapes. For these reasons not very much whole-wheat bread is eaten.

SOME OF THE UNLEAVENED BREADS WHICH PEOPLE EAT

The corn bread which is so popular in some parts of the United States is made without leaven. While there is gluten in corn, it is not the same as in wheat, and a loaf cannot be made from corn; but some kinds of bread made from corn are not only delicious but are very nourishing. Corn is often mixed with rye or wheat, and a good cheap bread is made.

Scotch oatcakes are made from oats roughly ground between two stones. In that way the Israelites made their bread when following Moses through the wilderness. It was unleavened, as are the Scotch oatcakes to-day. In the same way the East Indians and the people of Afghanistan make their bread still. In parts of the world where millet—the seed on which we feed pigeons and other birds—is more commonly grown than wheat, the people make good bread with it, but it is dry and brittle.

The black bread of Europe is made from rye or barley. The people who are accustomed to it seem to like it, but to us it seems sour and unattractive. Some rice is ground and used for cakes, but more of it is eaten whole. In South Africa durra, which is the seed of the sorghum, is made into bread. In some countries people grind peas or beans with grain and make bread out of the mixture. This is even more nourishing than bread made wholly from grain.

The principal form in which we eat unleavened bread is in hard crackers or biscuits. Some of these are very good, but they are rather dry. The Jewish people eat unleavened bread at the Passover as a reminder of former days.

THE MILLS IN WHICH THE GRAIN IS GROUND

Long ago the grain was crushed between two stones. Next came the mortar and pestle. You sometimes see these as a sign before a shop where drugs are sold. Next, the grain was ground between two stones, one of which revolved. There are still some old-fashioned mills of this sort to be found, but generally they have given way to what are called roller mills. Some of these are very large and can grind hundreds or even thousands of bushels of grain in a day.

In these the grain is crushed between sets of steel or porcelain rollers. The first set does little more than crack the grain. It then goes on to another set in which the rolls are a little closer together, and so on, until the fine white flour pours out. If you were to visit one of these mills you could see very little, as most of the machinery is covered up. Our pictures show you about as much as you could see in one of these great mills.

HOW THE BREAD WE EAT IS BAKED

Many people think that the very best bread of all is that made at home, far from the town bakery. If the bread-maker is skillful, perhaps this is true, but much care is needed to make good bread. Exactly the right amount of everything must be used; the temperature must be right for the dough to rise; it must be properly kneaded; and the oven must be kept at the proper temperature. It is easy to see why much bread made at home is not good.

Sometimes we find old-fashioned ovens in which they bake bread to-day just as they baked it hundreds of years ago. They put wood into the oven and set it alight, and keep it burning there until the oven has been made hot enough.

Then the oven is swept out, and the dough put in to make bread while there is still enough heat in the oven to bake it. There are more of these ovens in Europe than on this side of the Atlantic.

That is the way in which they used to bake the bread in Pompeii, the city which was buried by a volcano. Ovens have been found there with the burnt embers in them, just as they were made ready for baking on that terrible day when the boiling mountain threw up its ashes and buried the city under them.

THE GREAT BAKERIES AND THEIR MACHINES

More and more bread is being baked in great bakeries, where trained people watch every step in the mixing, kneading and baking. Machinery does most of the work, and it is almost true that no hand touches the bread until it is ready to put on the table. Some of these bakeries turn out many thousand loaves every day, and send them out in wagons, trucks, or on trains.

BREAD NEEDS BUTTER TO MAKE A PERFECT FOOD

Bread is an excellent food, but it needs something else. That something is milk or butter. To be sure, a glass of milk does not look very much like butter, but the butter is there, nevertheless. The milk is full of the tiniest particles of fat. The fat is not floating about in a mass in the milk. It is in a great many tiny globules, and each globule is neatly packed up in the tiniest, thinnest skin, or membrane. These globules are lighter than the milk, and most of them finally rise to the top. We call this thick top cream.

When the milk is churned, it is so violently knocked about that the tiny skins holding the fat break. The fat floats out, and the churning causes all the little drops of fat to become joined together. That mass of fat, after proper treatment, becomes the butter that we eat. In some parts of Europe people do not like butter as food. They make it and use it as an ointment, but take olive oil instead of butter for food. Long ago all the people who had butter used it as ointment.

It is supposed that the Arabs first learned how to make butter. They put milk into skins and carried it on the backs of camels through the desert; but the milk was so jolted about that the fat became churned into butter, and by accident the Arabs learned how to make this valuable food. Even now in India the natives make butter by shaking milk in bottles. In that hot country butter quickly goes bad, so it has to be made each day. An Englishman in India usually has his supply of butter made fresh every morning by a servant who churns cow's milk in a bottle.

In Europe peasants make butter by churning milk in goatskins. The women of Armenia put milk into a sort of cradle made of goatskin. This cradle is hung upon a frame and rocked until the fat of the milk becomes butter.

THE OLD-FASHIONED CHURN STILL IN USE

The old-fashioned churn was a slender vessel with a cover in which there was a round hole. The churn-dasher was a rod with crosspieces, or else a round board at one end. This was placed in the milk in the churn, and the rod was slipped through the hole in the cover. The rod was lifted up and down regularly, and at every stroke the milk was stirred and beaten. After a time the "butter would come," and the particles could be seen floating on the milk. When they were taken out, the milk was called buttermilk.

Other forms of churns were invented which made the work easier. Most of these were made on the principle of an ice-cream freezer and were worked by turning a crank. From these it was only a step to the great churns holding many gallons and turned by machinery.

In the great dairies the cream is separated from the milk, and only the cream is churned. The separator is a wonderful little machine which gets nearly all the fat from the milk. Many farmers own separators and either churn their own cream or else sell it to the butter-makers. The skimmed milk is still a valuable food, even if the fat has been taken out, and is fed to the pigs or the chickens.

We show you some pictures of one of the great dairies, which supplies thousands of families with whole milk, buttermilk, cream and butter. It requires the milk of thousands of cows to supply its customers. Much of the milk used in a great city may come from farms more than a hundred miles away. Some comes from even greater distances.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 405.

REAPING THE GOLDEN GRAIN IN THE WEST

On a previous page you saw wheat being reaped on an ordinary farm. Here is one of the great wheat-fields to be seen in the western part of Canada and the United States. The engine is pulling several reapers, and in the far distance many horses are also at work. The men are stacking the sheaves which have been thrown out by the reapers as they pass along.

This is a closer view of the binders at work. The engine pulls four, each a little farther to the left than the other. Each cuts the grain in front of it, and binds it into sheaves, which are pushed out upon the ground. The engine runs upon ground from which the wheat has been cut.

THE WHEAT STARTS TOWARD THE MARKET

The threshing machine is nearly surrounded by wagons from which men are tossing the wheat into its throat. Inside, the wheat is separated from the straw and chaff, and pours into the wagon on the right through the pipe. The engine burns straw, and requires the service of one man to feed it. The wire-gauze cap over the smokestack prevents sparks from flying.

In the great wheat-raising sections sights like this are common. The wheat has been weighed and the bags sewed up. Horses, or a traction engine, draw it to the railroad. It may be ground into flour there, or may be taken to a mill elsewhere, or perhaps may cross the ocean.

Photos, pages 374, 375, Brown Bros.

THE MILLS THAT GRIND THE GRAIN

The wheat must now go to the mill to be ground. Mills are driven by wind, water, steam or electricity. The arms of the windmill catch the wind, which causes them to revolve, and, by so doing, to set the grinding stones to work inside the mill. Nearly all mills are driven by steam, and windmills and water-mills are rarely built. Steam-mills are more reliable, but the others are prettier.

When the miller at the water-mill grinds wheat, he closes gates, or sluices, in the stream, so causing the water to collect. When the water is released, it rushes over the wheel and makes it spin. The turning of the wheel makes the grinding stones go round. Some mills have the wheel inside, the water flowing through a sluice making the wheel go round by racing under.

GREAT MODERN ROLLER MILLS

© Underwood & Underwood, New York.

Such mills as those on the page before are rarely seen now. Here are some of the great mills where thousands of barrels of flour are made every day by a different method. The wheat is crushed between heavy steel rollers. The cars bring the wheat to the doors and take away the flour.

Here is a nearer view of a large roller mill which can grind a hundred times as much as the mills on the other page. The great tank-like structures are wheat elevators which take the wheat from cars or boats and send it into the mill as needed. Some of these elevators hold many thousands of bushels. The flour is taken away by trucks, railway cars or by boats in the river.

THE INSIDE OF A GREAT FLOUR MILL

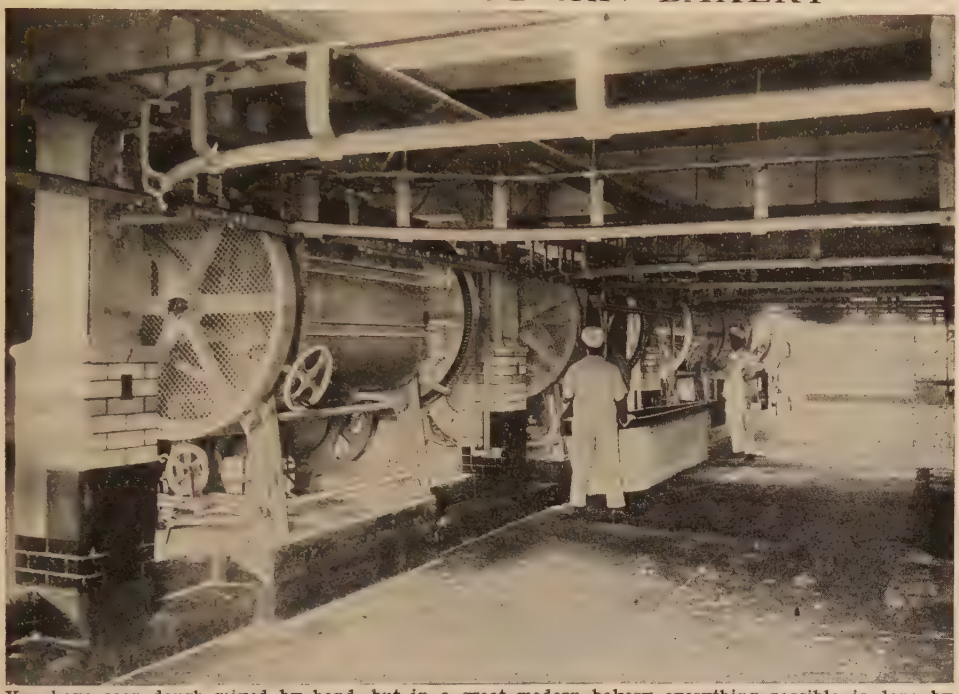
After being scoured to remove impurities, wheat is led to these boxes, which contain sets of steel or porcelain rollers. The first set break the kernel, and each of the sets which follow are placed a little closer together than the set before.

After the products have gone through the different sets of rollers, the flour is sifted out through silk cloths contained in these tanks. These are called bolting cloths, and the flour which goes through is drawn off at the bottom.

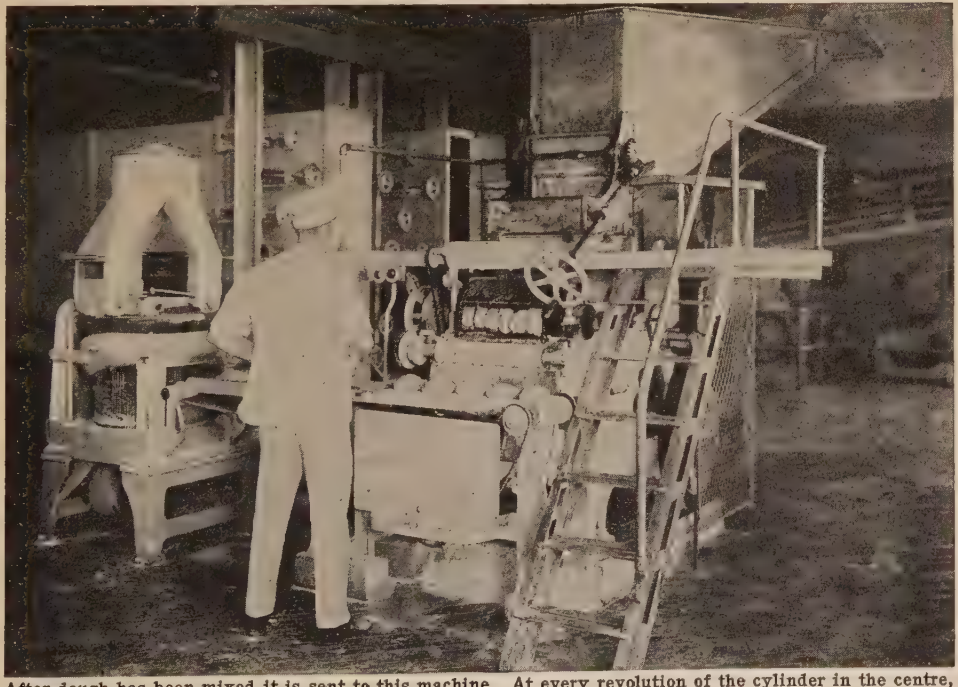
After the wheat has gone through the machines shown above, and many others, it is flour. Here it is being packed to go to the baker or the home. The weighing machine will fill either barrels or sacks, and can be set to deliver any number of pounds. When the proper amount has come down, the stream is shut off until another barrel is ready to receive it.

Photos, Brown Bros.

IN A LARGE MODERN BAKERY



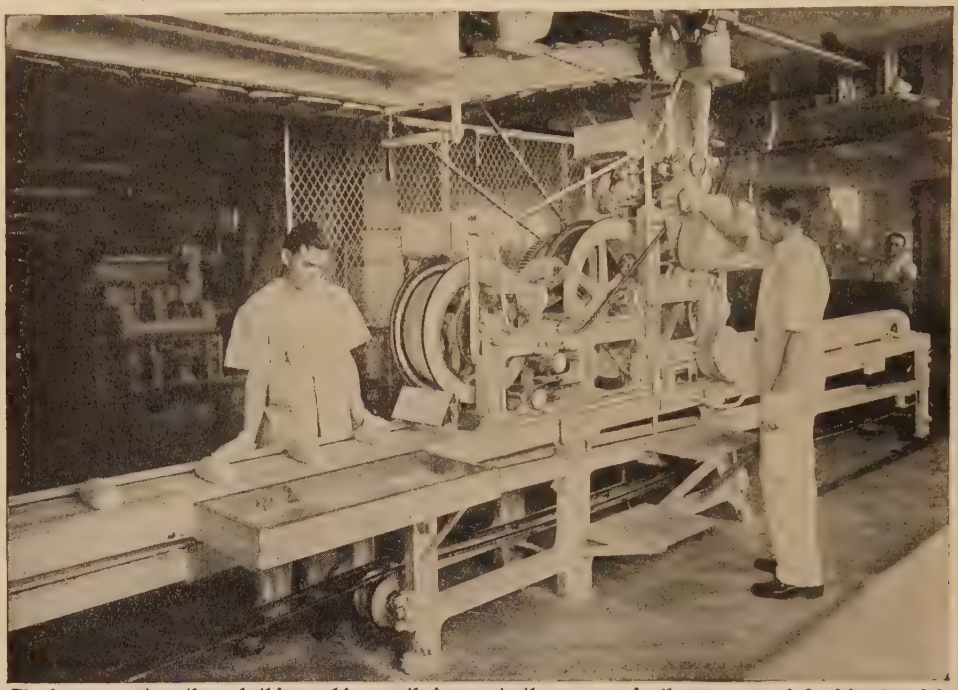
You have seen dough mixed by hand, but in a great modern bakery everything possible is done by machinery. All the ingredients are carefully weighed, and then the dough is placed in these great mixers, which knead it more thoroughly than can be done by hand. Each machine mixes enough dough for 1,600 loaves of bread. Everything about a bakery must be kept clean.



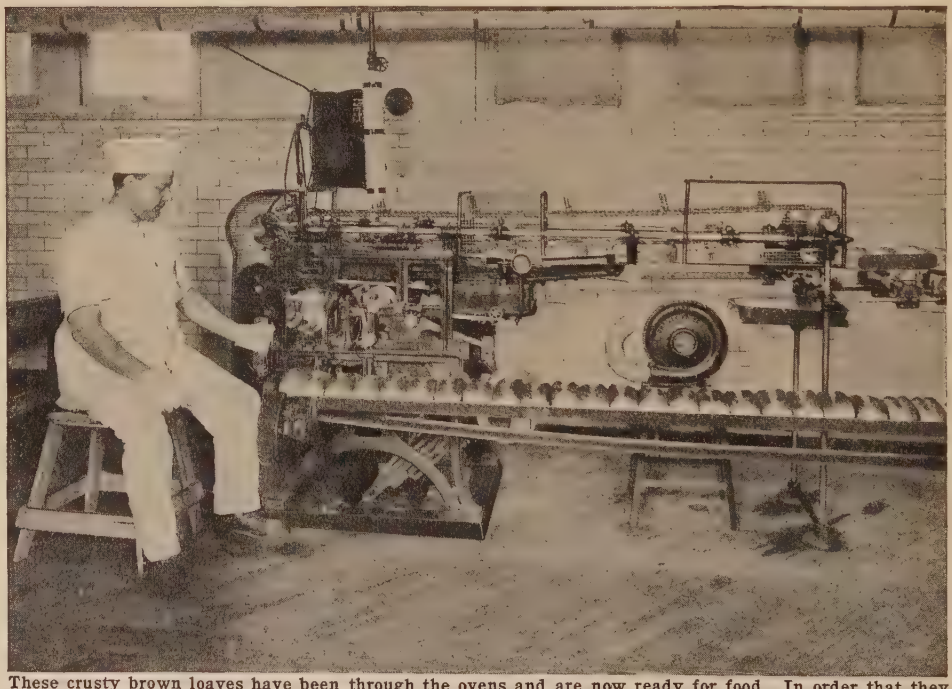
After dough has been mixed it is sent to this machine. At every revolution of the cylinder in the centre, enough dough to make six loaves is cut off and divided. The loaves are then shaped. The man in charge has little to do unless something goes wrong.

Pictures on this page and the next by courtesy of the Ward Baking Co.

BREAD NOT TOUCHED BY HANDS



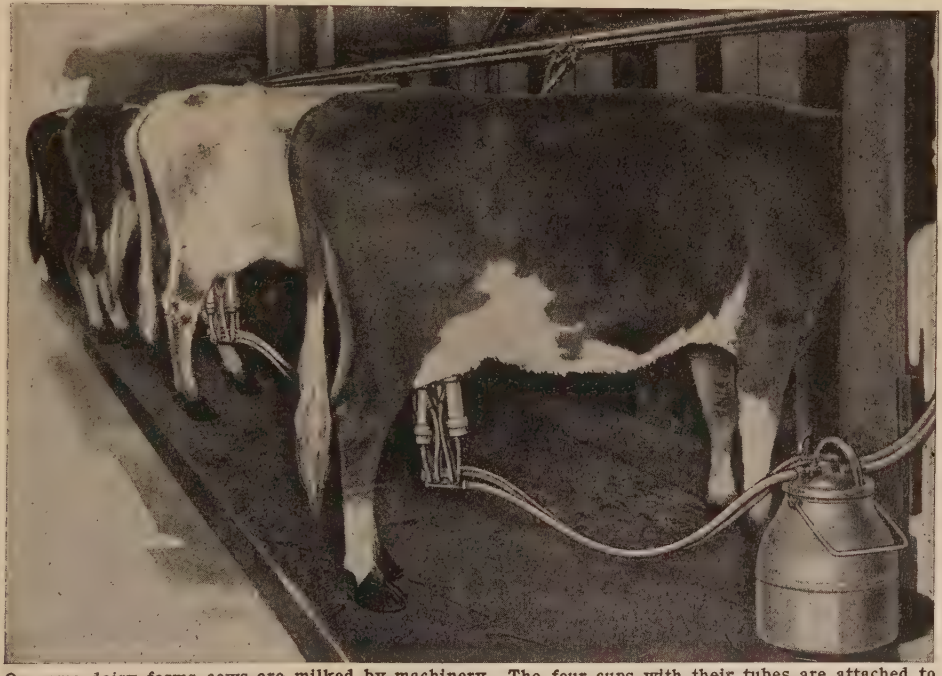
The loaves next go through this machine on their way to the ovens. As they pass, each loaf is placed in a separate pan and travels along a belt toward the ovens, which are not shown. You can see great piles of pans stacked on the right end of the machine, beyond the man in white.



These crusty brown loaves have been through the ovens and are now ready for food. In order that they may come to you perfectly clean, this machine wraps each loaf in waxed paper and fastens the covering securely. You can see the uncovered loaves moving to the left in the lower belt and moving to the right above. These loaves will soon be distributed over the city.

WHERE THE BUTTER COMES FROM

This is the interior of a model dairy barn which holds fifty cows. The barn is light; the floor is of cement, which is kept clean by a hose; the cows are brushed and washed every day; and the men wear suits of white duck, which are put on at milking time and kept for that work only.



On some dairy farms cows are milked by machinery. The four cups with their tubes are attached to the udders. A pump, driven by an electric motor or a small engine, produces a vacuum, first in the front and then in the rear cups. The vacuum draws the milk into the cups, from which it runs into the can. The vacuum is produced and released nearly fifty times a minute. Many cows can be milked at the same time, thus saving much time and hard labor.

Upper picture, copyright, Underwood & Underwood, New York; lower, courtesy of De Laval Separator Co.

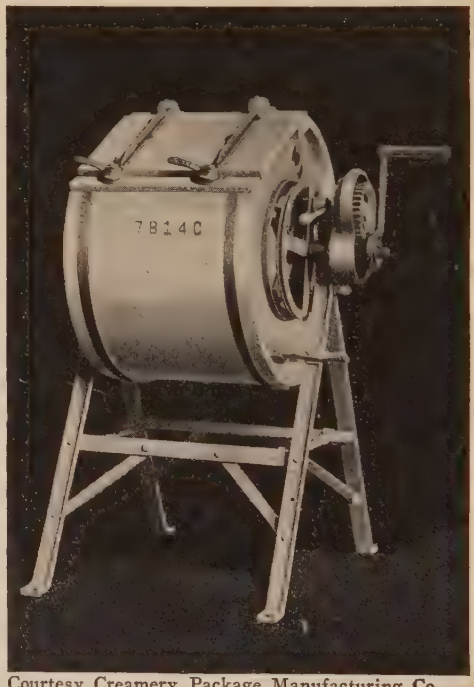
SEPARATING CREAM AND MAKING BUTTER

Courtesy De Laval Separator Co.

SEPARATORS of all sizes can be had. Some worked by hand will separate the cream from only seventy-five quarts or less in an hour. The largest driven by power will separate thirty or forty times as much. The size which the dairyman buys depends upon the quantity of milk which he wishes to separate. Of course a small separator can be run several hours, if necessary, but usually the dairyman prefers to buy a machine large enough to do the work in a short time. The cream is more easily separated from milk warm from the cow. Then, too, it is desirable that milk and cream be cooled as soon as possible in order to hinder the growth of harmful bacteria.

When the cream has been separated, it may be sold for use as cream, or it may be sold to the butter-maker, or it may be made into butter on the premises. We show you pictures of butter-making on other pages besides this. The skim milk is one of the best foods for chickens, pigs and calves. Though it has lost the fat, and we say that it is not as rich as whole milk, it has the bone- and muscle-forming elements left, and animals thrive upon it. Much of the so-called buttermilk sold in the cities is skim milk to which the bacteria which develop lactic acid have been added. It is a healthful drink and many people like it. The cottage cheese sold in the markets is also made from skim milk.

On farms where only a few cows are kept one may yet see old-fashioned churns like this. The fat globules are broken up by the churn dasher, which is moved up and down. Photo, Brown Bros.



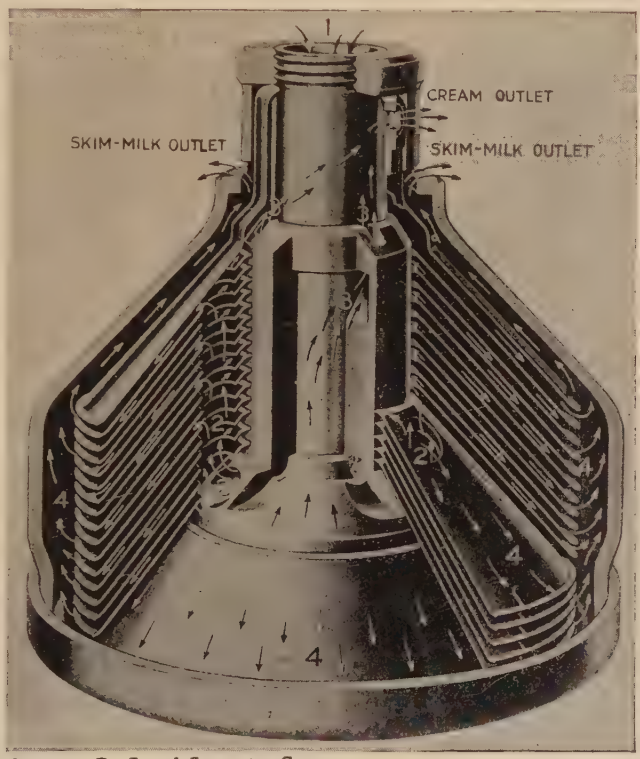
Courtesy Creamery Package Manufacturing Co.

On larger farms such a churn as this is used. This one is turned by hand, but it is easy to use an electric motor or other form of power.

HOW A CREAM-SEPARATOR WORKS

WE have already told you in the story that the fat in the milk is lighter than the milk itself and therefore has a tendency to rise toward the top. When the cream has risen, it can then be poured or skimmed off. However, all of the fat does not find its way to the top, and no matter how carefully the milk is skimmed, some of the cream is always left in the milk. Then, too, the cream rises very slowly and often becomes sour before it has come to the top.

Where dairies sell most of their milk for drinking they do not run very much of their milk through a separator, unless they happen to have more milk than they can sell, at certain seasons of the year. Their customers demand the whole food value of the milk and can see the amount of cream which rises to the top of the milk through the bottle. If the amount is too small they refuse to buy the milk. Many dairies, however, find it more convenient or more profitable to sell cream or butter than whole milk, and they wish to get every particle of the cream from the milk. On such farms a separator is a necessity. For this reason several millions of these machines are in use in all parts of this and other countries.



Courtesy De Laval Separator Company.

THE INSIDE OF A SEPARATOR

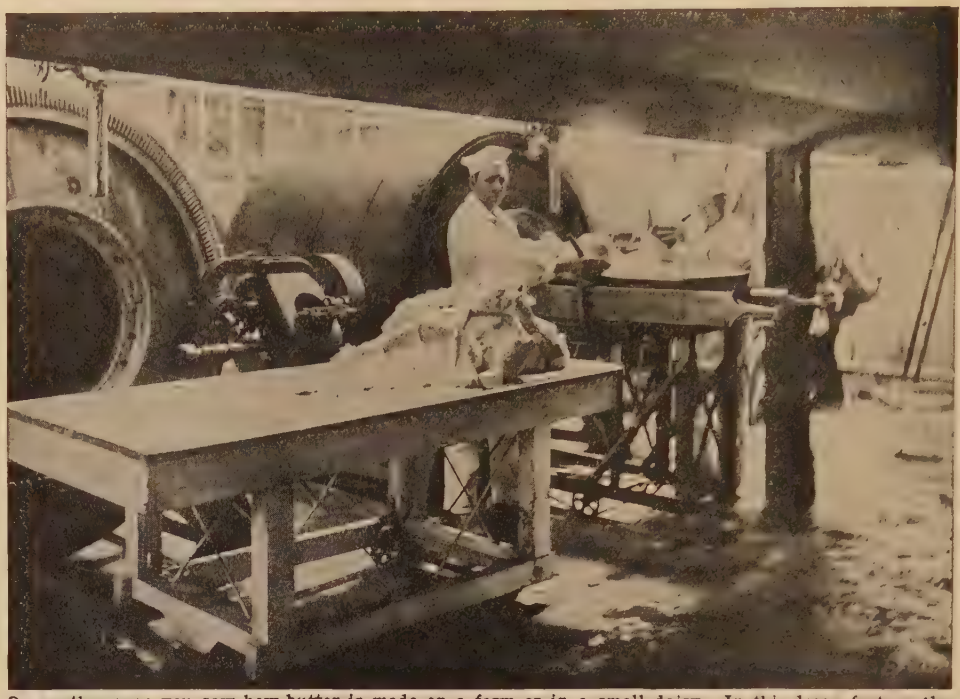
The principle of the separator is very simple. You know that when anything is whirled around in a circle the heavier parts struggle hardest to get away from the centre. Nearly seventy-five years ago men began to experiment with the idea of separating the cream from the milk on this idea, but success did not come until later. In 1877 Dr. Carl Gustaf Patrick De Laval, a young Swedish engineer, invented the first continuous cream-separator based upon this principle. Many improvements have been made since, and the separator of to-day looks quite unlike the first one, though the principle is the same.

Now let us see how one type of separator works. Look first at the picture on the opposite page, which shows the whole machine at work. Then look at the picture on this page. The outer can, which protects the working parts and to which the spouts are attached, has been removed. What you see is the lower bowl with nearly half of the side and a little less than half of the disks cut away. These disks are really circular and are shaped like funnels, with a little space between. Now read the description in the next paragraph. Notice carefully the figures, the lettering on the picture and the direction of the arrows.

The milk is poured into the upper bowl (not shown in this picture) from the cans or pails into which it was milked. It must flow regularly and not too rapidly into the lower bowl. The flow of the milk, as you see, is controlled by a faucet (shown on opposite page). It passes into the lower bowl through the channel marked 1 in the picture on this page. This lower bowl should revolve about 6,000 revolutions per minute. If it runs too slowly a warning bell rings. The plates, or disks, in the bowl, except the top one, have large holes in them, and through these the milk gets into the spaces between the disks. Notice the figure 2 in the cut which shows the path of the milk from 1. The terrific speed has a tendency to drive the heavier part of the milk away from the centre. It follows the bottoms of the disks and reaches the outside shell. It cannot stay there because it is being pushed from behind by the milk which is running into the bowl. So it follows the line of arrows marked with the figure 4 and escapes through the skim-milk outlet. Meanwhile the lighter cream has been pushed toward the centre and goes through the holes marked 3 into a separate chamber, and escapes through the cream outlet. The cream also is being pushed from behind. In the picture on the opposite page you see the skim milk pouring from one spout and the cream from the other.

Few machines ever invented have been of more value to the dairy farmer than the separator. The saving of both time and labor made possible by its common use is truly enormous.

MAKING BUTTER BY MACHINERY



On another page you saw how butter is made on a farm or in a small dairy. In this large factory the cream is first pasteurized and then is run into the great churns which break up the fat globules and collect them as butter. The moisture is worked out by machinery, the butter is removed from the churns and then goes to the next room to be packed for market.

The butter is often made into prints by hand. The molds are filled from the great mound of butter on the table, and the blocks are weighed and wrapped in parchment paper. They are then packed in boxes and taken to the cooling room to become thoroughly chilled.

Photos, Brown Bros.